DECEMBER 12, 1960

American Machinist / Metalworking Manufacturing

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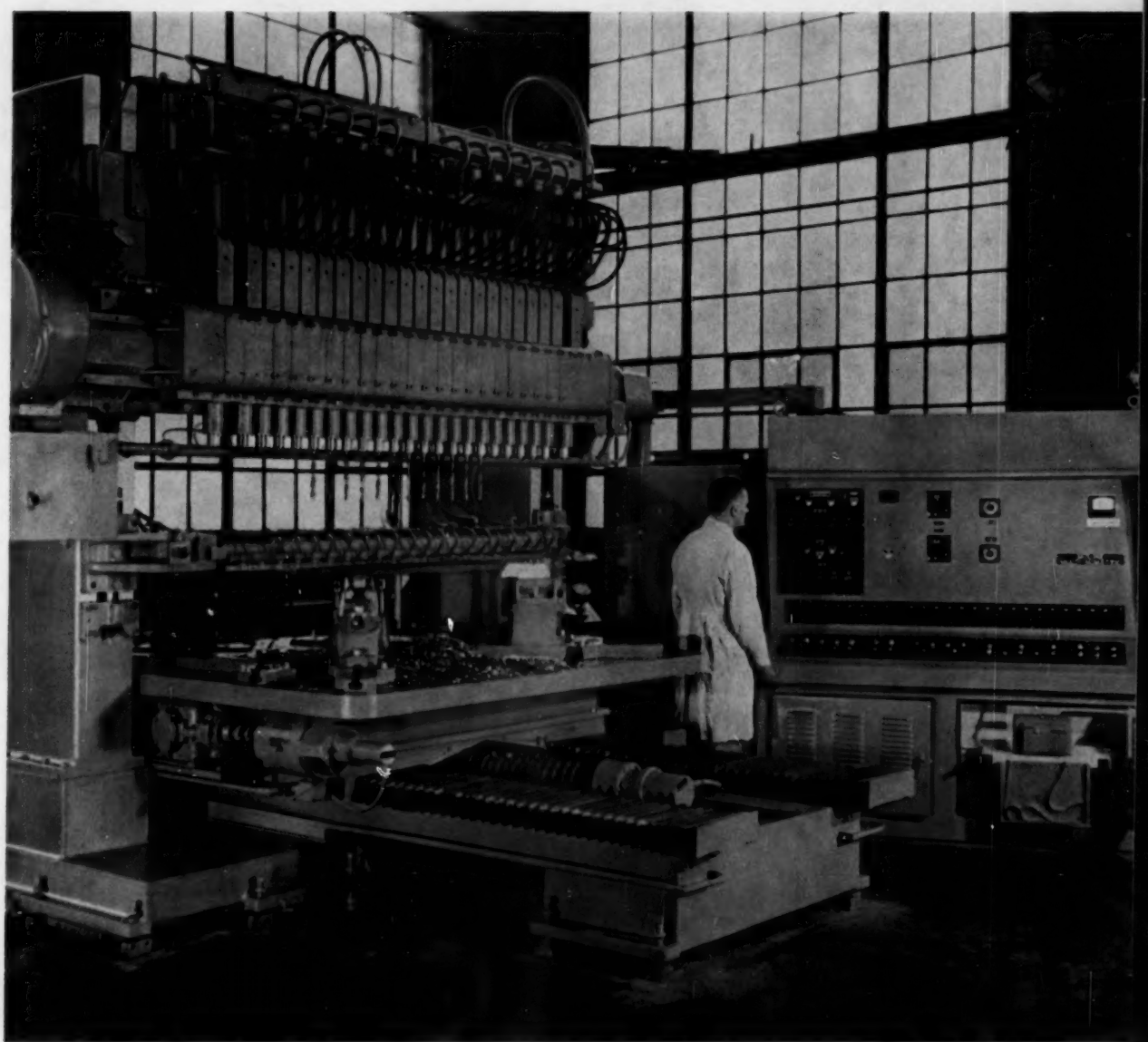

Tape selects drill pattern and positions work for drilling—see page 120

- **How to select an adjustable-speed drive,** page 99
- **Optical tooling tackles a tough job,** page 116
- **Where to locate your plant,** page 121

As these scale models show, Heald's new line of standard "building-block" units can be combined in virtually any desired arrangement for single or multiple station automated production equipment. Slide units and Borizers can approach the work vertically, horizontally or at an angle, to perform any desired drilling, boring, reaming, tapping, probing, facing or grooving operations within their range and capacity.

The flexibility of these standard units provides maximum versatility in meeting your specific automation requirements—simplifies even major job changeovers by facilitating retooling, removal, relocation or addition of work stations—and safeguards your investment by substantially reducing losses from obsolescence.

Your Heald engineer will be glad to show you how this "building-block" approach can solve your automation problems from rough to finish.

It PAYS to come to Heald

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.
Worcester 6, Massachusetts

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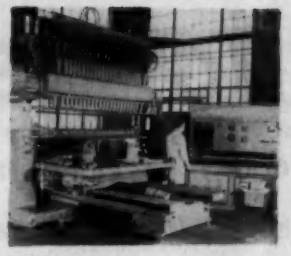
HEALD®

CIRCLE 246 READER SERVICE CARD

COVER:
23-spindle drill with numerical control of table and spindle selection built by Moline Tool Co. See page 120.



American Machinist / *Metalworking Manufacturing*

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TURN PAGE FOR METALWORKING REPORT ——→

METALWORKING REPORT

... what's new and significant in manufacturing techniques and materials—direct from our own staff and round-the-world news bureaus

CUTTING . . . **Coolant cooler** now being market-researched by Cincinnati Air Conditioning is designed to **hold coolant tank** at **constant temperature.** This should result in much better temperature control at the work **on high-precision machine tools** such as grinders, boring machines, and lathes; and allow jig boring with coolants. Less coolant can be applied in some cases, which means smaller filters and pumps.

ASSEMBLY . . . **Fast epoxy adhesive** cures in 60 seconds, and will **accelerate to 45 sec** under infra-red heat lamps. Introduced by Allaco Products, Cambridge, Mass, the resin will bond metal to metal, metal to plastic, and practically any other materials without heating ovens. It is **fast enough** to work in automatic metering-mixing-dispensing machines **for high-production assembly,** where it should cut direct labor and clamping time.

HEAT TREATING . . . **Fluidized-bed quench** at Boeing has cooled down small parts from **1600 to 200 F in five seconds.** The Boeing-designed and built unit operates so fast because **no vapor phase** forms to retard heat transfer, as is common in liquid quenching baths. Results in the work are said equal or superior to water or oil baths.

INSPECTION . . . **Automatic magnetic-particle inspection** checks steering-gear elements from 3 to 12 in. long by handling them on an 8-spoke indexing wheel. The Fel-Electric, Ltd, (England) machine **sprays on magnetic-particle ink,** then cycles the parts through an AC magnetic field to reveal longitudinal flaws and through a DC field to show up transverse flaws. The unit is **for continuous production** of small parts.

FORMING . . . **Heavy presses make spare parts** for aircraft and missiles. A current study by Engineering Supervision Co and Wyman-Gordon has turned up some good examples of **machined parts that can be forged**—thus taking up some of the **excess capacity** of the Air Force machines. Projects to be covered include (1) **raised ribs** in thin panels of aluminum and other metals, (2) **deep-drawn parts** (up to 48 in.) starting with blanks up to 140 in. long, (3) **right-angle ribs** in cones, and (4) **closed-die forging** to produce tank hulls.

MATERIALS . . . **Titanium is a brazing alloy** for assemblies made of **columbium** and designed to operate at 3000 F, according to an ASME paper (Annual Meeting) by M M Schwartz of The Martin Co, Baltimore. Pure Ti works best in a specially designed 3300-F **cold-wall vacuum furnace** developed for this and other work **up to 4500 F.** The furnace has internal elements and requires pressure reduced down to the 1-micron range.

INSPECTION . . . **"In-motion" X-ray setup** at North American Aviation moves a 10 x 20-ft panel for the B-70 past the X-ray head. **A tiltable fixture** supports the panel with X-ray film fastened to one side. Key feature is a lead-shielded collimator that **creates a sharp exposure** only on the side of the sheet being inspected. The equipment was built by X-Ray Products Co, Pico-Rivera, Calif.

FORMING . . . Punch assemblies for louvres or slots have been developed by Tru-Tex div, H & R Supply Co, Cincinnati, to operate with standardized perforating blades held in **slots in a punch cluster** or retainer. Blades can be **exchanged, reground, or ground all together.** The holders attach to standard die sets without restrictions as to hole shapes and location.

COMPONENTS . . . Relay-modification kits made by Clark Controller Co, Cleveland, are color-coded to permit **modifying standard relays** to virtually any switching-circuit control required, on the spot. The kit system provides more **flexible parts stock** with **smaller inventory** and **faster relay replacement.** Color diagrams show where to apply the kits on the various basic relays.

WELDING . . . One-handed brazing and hard-facing torch sprays powdered metals into the oxy-acetylene flame, which carries the metal to the work where it fuses. An **adjustable vibrator unit** dispenses the powdered metal when the operator presses a control button on the torch handle. A **carrier gas moves the metal** through its own tubing to the flame. Called Aircospray, the system will pick up flux with the acetylene gas as it moves toward the torch.

MATERIALS . . . "Thermofusion" forms large containers from powdered polyethylene—larger than any other molding method. The European development forms **cylindrical tanks in metal molds.** The tanks can be hot-gas welded to build up larger tanks. The tradename is applied by Spencer Chemical Co.

FORMING . . . Forging in a can produces parts from **beryllium powder**, which compacts to **full metal density,** then plastically flows into required die shape. Forging temperature is below 2000 F (though still high enough to oxidize the beryllium, which is the reason for the enclosing can), and pressure is up to 75,000 psi. Wyman-Gordon at Worcester, Mass, applies the **exclusive process.**

INSPECTION . . . Ultrasonic tester checks adhesive bonds in joints of aircraft and missile structures. The non-destructive device, developed by Fokker Royal (Netherlands) Aircraft Factories, **checks bonded joints in tension or shear with ultrasonic loading.** In experimental testing of production specimens, the instrument **describes strength of shear fronts with 95% accuracy;** it also points out voids or lack of adhesion.

FINISHING . . . Fast-dry indoor-outdoor paint developed by Parker Rust-Proof Co dries so quickly that the **overspray falls on the ground** as dust or blows away in the breeze. Tropical Dri-Spray is available in white or aluminum, and can be applied to any desired thickness by repeated spray-gun passes with **no risk of runs or lap marks.**

Continued on next page

Coming in AM/MM

How to bore a curved hole
Japanese tests prove ceramic tools
What a computer does to your company

METALWORKING REPORT . . .

FORMING . . . Sealing machine for powder-metal parts, evidently first on the market, is designed to seal and fill the parts with a special-formulation thermosetting plastic. The National Sinter-Seal Co development will also **impregnate oil or wax** into **die castings** after minor adaptation. Capacity is 5400 cu in. of filling/hr, completing a four-step process in 10 minutes/part or less.

WELDING . . . Silver-brazing filler metal with a flux core **eliminates fluxing as a separate operation.** The operator heats the joint area with a torch and wipes the joint with the flux-cored wire. At 950 F the flux spews out and cleans the work; at 1150 F the filler metal melts and flows where the flux has been wiped on. Aircosil 45 Fluxor contains 45% silver. Airco sells it in "equivalent sizes"—that are equal in weight per ft to a solid wire, but larger in diameter.

MANUFACTURING CONTROL . . . Laboratories solve practical shop problems at A O Smith Corp, where all **labs have been pooled** to form a "Centralized Material and Process Control." The point is to focus all lab functions on solving **material and process bottlenecks** that arise in the shop. In only 12 months this plan has saved $1-million. For details, see p 106.

CUTTING . . . Coolant makes a sharp difference in machining **18-8 stainless,** according to tests in Japan. A chlorinated oil or chemical cutting fluid may **increase cutting speed** up to 1/3 for 100-minute flank-wear life. It can **increase flank-wear life greatly,** but has **minor effect on cratering.** The cutting fluid has much more value as a lubricant, according to tests, than as a coolant.

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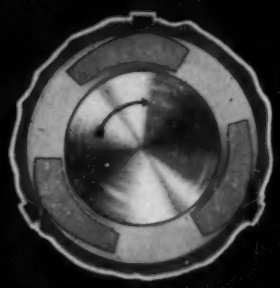


FILMATIC Grinding Wheel Spindle Bearings never wear out

ACRASIZE Gaging System calls the signals for

Cincinnati supplies Cimcool Cutting Fluid and Positive Duplication Grinding Wheels

Engineering Service Grinding Specialists study the problem from every angle

CINCINNATI®
GRINDING MACHINE DIVISION

PRECISION GRINDING MACHINES:
CENTERTYPE • CENTERLESS • MICRO-CENTRIC • ROLL CHUCKING • CENTERLESS LAPPING

CINCINNATI FILMATIC®

Precision Grinding Machines engineered and built for the job by

CINCINNATI | GRINDING MACHINE DIVISION

give you tight control of quality and production

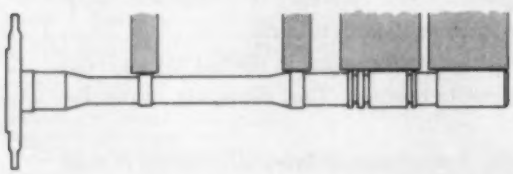
Management specifies, but who determines quality and production of precision grinding? For toolroom and general purpose machines, the operator is still the boss. However, increased application of automation transfers responsibility to management, while upgrading the machine operator to machine supervisor. Cincinnati's Grinding Machine Division promotes this trend toward management control of quality and production. Their Specialists engineer and build many types of precision grinding machines and complete lines having any degree of automation.

Principle requirements for management control are top-flight manufacturing engineering and reliability of production equipment. In these areas, Cincinnati leads the field.

- Reliability of machine performance is typified by FILMATIC grinding wheel spindle bearings. They never are responsible for down-time.
- Precision Grinding Specialists coordinate all elements of manufacturing engineering.
- Gaging systems are a responsibility of Cincinnati Milling's CIMTROL Division.
- Cutting fluids and grinding wheels, products of Cincinnati Milling's Products Division, are selected for each job.

Only Cincinnati can give you unified responsibility for the complete performance of precision grinding equipment. May we show you how we can help? You will get a general idea by reading about the examples on the two pages following. **Grinding Machine Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.**

Widely spaced diameters are automatically ground on transmission output shafts. Drawing below indicates ground diameters. Cincinnati Cost-Cutting Specialists equipped a 10" x 36" Plain Hydraulic Grinder for this work. Production: 92 per 48 minute hour.



CINCINNATI

FILMATIC

Completely equipped by Cincinnati Cost-Cutting Specialists for reliable, automatic production. The machine is a CINCINNATI FILMATIC 10" Plain Hydraulic Grinder. Information on standard machines in catalogs G-660-3 and G-661-2.

BUILDERS OF PRECISION GRINDING MACHINES: CENTERTYPE • CENTERLESS • MICRO-CENTRIC

THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO

CIRCLE 250 READER SERVICE CARD

Automatic Centertype Grinders built by

CINCINNATI | GRINDING MACHINE DIVISION

the production line ROLLING!

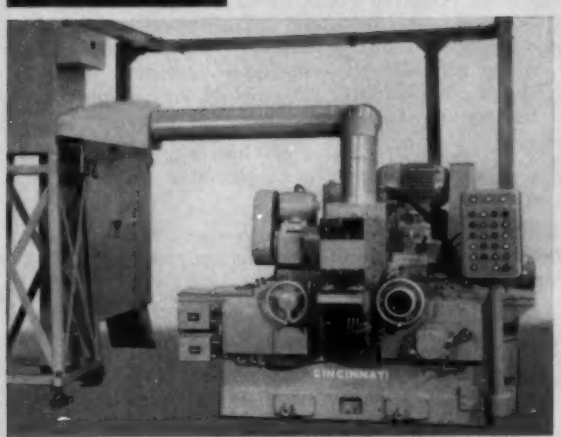
It takes considerable ingenuity to automate centertype grinding machines for continuous production duty. But it can be done quite effectively, as shown by the example illustrated here. The machine is a CINCINNATI FILMATIC 10" x 36" Plain Hydraulic Grinder, one of hundreds engineered and built for various operations by Cincinnati's Grinding Machine Division.

The machine automatically grinds several diameters on transmission output shafts, using multiple wheels having a 16" span.

Production feature-advantages engineered into this machine by Cincinnati Cost-Cutting Specialists include:

- Semi-automatic loading fixtures
- ACRASIZE Gaging System, with "jump on" probing unit
- Hydraulic automatic back rest
- Gap eliminator, to minimize the "grinding air" segment of the automatic infeed cycle
- Automatic wheel truing, including rapid traverse between wheels

FILMATIC grinding wheel spindle bearings and other standard feature-advantages contribute importantly to the extra reliable performance of Cincinnati cost-engineered Grinding Machines. Engineering service second to none; the industry's widest selection of precision grinding machines; our own ACRASIZE Gaging Systems; Cimcool cutting fluids and grinding wheels; these and 40 years' experience in precision grinding are your assurance of the most reliable cost-cutting equipment available anywhere. May we help in solving your manufacturing engineering problems in the areas of precision grinding?



Exhaust to eliminate cutting fluid mist is one type of equipment included with this CINCINNATI FILMATIC 6" x 18" Plain Hydraulic Grinding Machine equipped for automatic production.

• ROLL • CHUCKING • CENTERLESS LAPPING

CINCINNATI®
GRINDING MACHINE DIVISION

CIRCLE 251 READER SERVICE CARD

how's this for high-speed hobbing?

WORK PIECE					HOB (1 start)				Pieces per Load	Method*	Time per Piece	Pieces per Grind	Cut
Dia. Pitch	No. of Teeth	Helix Angle	Face Width	Material	Dia.	RPM	Feet PM	Feed					
10	20	15°	1¾"	1040 leaded	3"	500	395	.055"	1	A	2 min 25 sec.	150	Finish
7	23	13°	¾"	8620	4"	350	370	.100"	2	A and B	59 sec.	240	Pre-shave
5	43	24°	1⅝"	8620	4"	280	300	.100"	2	B	3 min 45 sec.	80	Pre-shave

** Method A: Diagonal Hobbing. Method B: Step-by-step Hobbing.*

This is the kind of performance you get with

THE FELLOWS-PFAUTER P400 HIGH-SPEED HOBBING MACHINE

HIGH-SPEED HOBBING. Performance speaks louder than words. The examples given above show the results of high-speed hobbing which can cut costs. The figures are taken from the records of typical production runs on the Fellows-Pfauter P400.

DESIGN. The P400 was designed for High-Speed Hobbing, and it features a new basic design. The individual machine elements are of maximum rigidity. The hob head is heavy and rugged, the machine column and bed are of double-wall construction with heavy V-ways and the work table is as large as the maximum permissible work piece diameter. The index worm gear is nearly as large as the work table, and the work support column is of massive construction. All parts of the machine are properly proportioned and of sturdy design to eliminate vibration. The cost is more than justified by the resulting reductions in hobbing times and the increased hob life.

RIGIDITY and CLOSE TOLERANCES. The large size work table and index worm gear and the oversize hob head, which eliminates lead errors caused by hob breakout, are important factors in providing the rigidity necessary to hold work to close tolerances.

COMPLETELY OPEN WORKING AREA. The machine and the work-support columns are of such rigid construction that the hobbing stresses are absorbed without requiring an over-arm. Therefore the working area is easily accessible for set-up and work loading. The automatic retraction of the table from the hob also facilitates changing of work.

SET-UP TIMES and FLOOR-TO-FLOOR TIMES are reduced on the P400 because it has infinitely variable speeds and feeds, rapid traverses for all machine movements, including hob shifting manually by push button, and built-in hydraulics for the operation of the tailstock and simple hydraulic fixtures used on this machine.

AUTOMATION on the P400 is simple and fast. The illustrations show a machine equipped with automatic loading and unloading devices.

GEAR HOBBING COSTS can be cut by high-speed hobbing on a P400 because of the resulting savings in production time, floor space, maintenance and labor.

THE FELLOWS GEAR SHAPER COMPANY 78 River Street, Springfield, Vermont, U.S.A.

Branch Offices: 1048 North Woodward Ave., Royal Oak, Mich.
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THE PRECISION LINE

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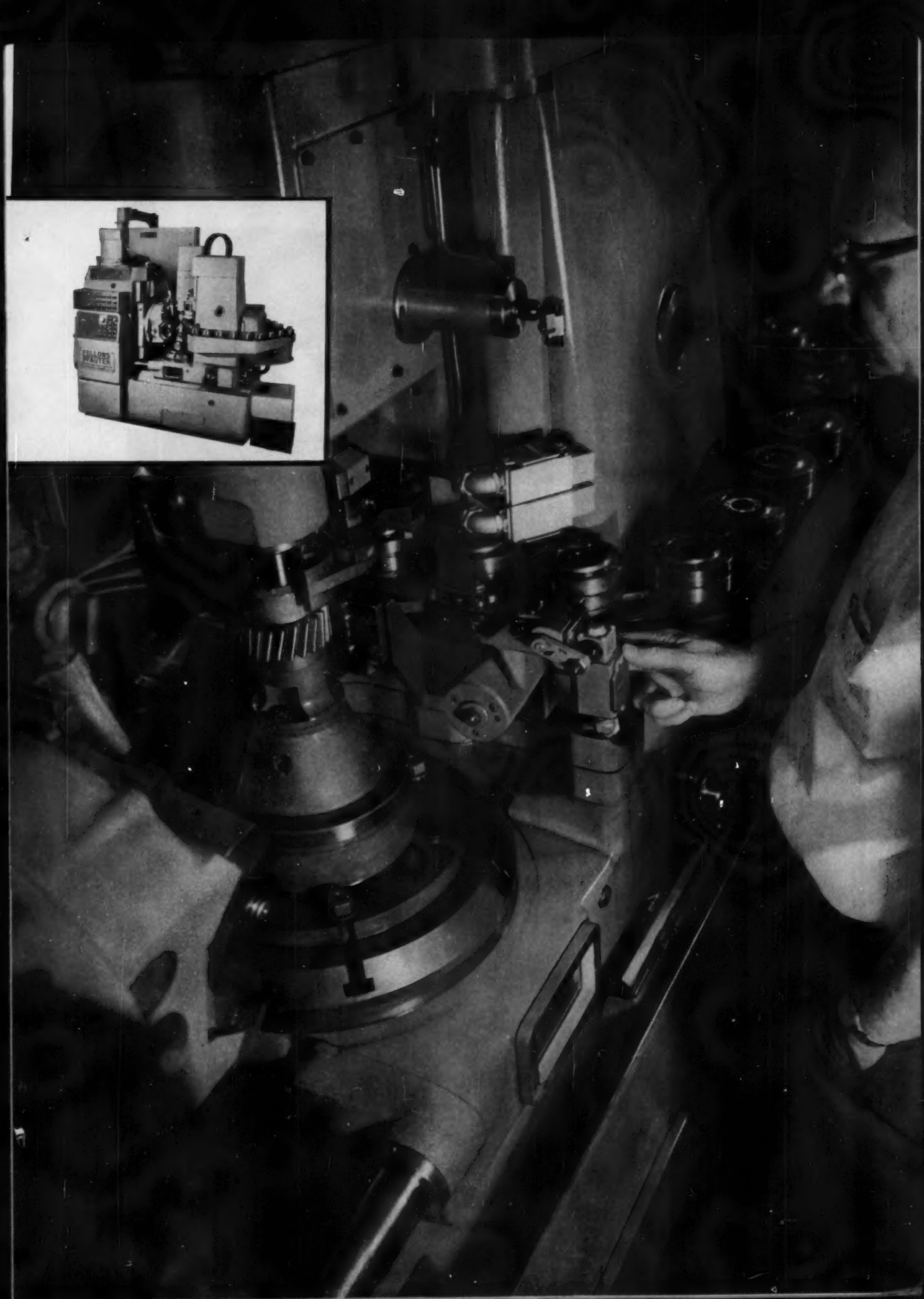
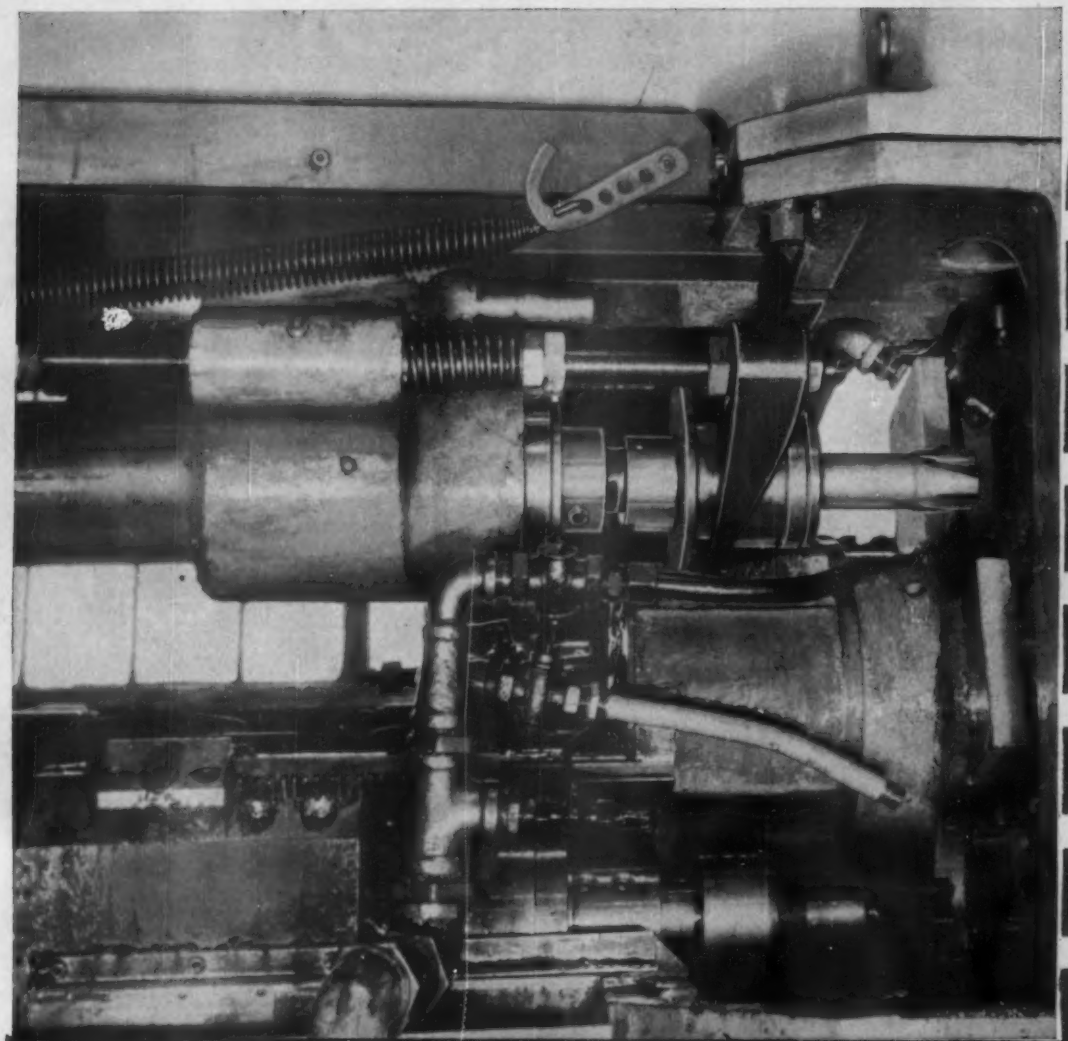
Gear Production Equipment

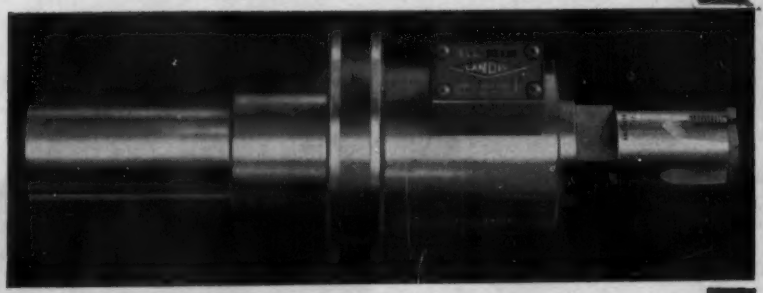




LANDIS TAP

for bar automatics...

3000 pieces between grinds at 140 SFM



A LANDIS, Rotary Style, Collapsible Tap is giving excellent chaser life producing taper threads during high-speed machining runs at the Grabler Manufacturing Co., Cleveland, Ohio.

The 2LL Tap, equipped with a 1½" extra long head; is shown installed in the right-hand third position on a New Britain Automatic machining 350 malleable iron union bodies per hour. Though threading at the high speed of 140 SFM, 3000 1½" 11½ pitch NPT threads are produced between chaser grinds.

LANDIS LL Receding Chaser Collapsible Taps, designed especially for taper threading, feature a receding action that contributes to excellent chaser life. A precision mechanism diametrically recedes the chasers during threading at a rate equal to the desired thread taper. This reduces cutting strains by restricting cutting action to the throat or chamfer section, and provides longer chaser life between grinds. An important additional feature of this receding action is the generation of a truly conical taper thread with no chaser leave off marks.

LL Taps can be furnished for rotary or stationary applications from 1 5/16" to 20" in diameter . . . the 2LL illustrated here, using 5 different Tap Heads, will thread all pipe diameters from 1" to 2½". For more details, write for Bulletin G-95 . . . perhaps your plant has an internal taper problem that may be simplified by a LANDIS LL Collapsible Tap.

505C

LANDIS *Machine* COMPANY

WAYNESBORO • PENNSYLVANIA

THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT - CUTTING - TAPPING - GRINDING - ROLLING

Now . . . a completely automatic

crankshaft grinder with indexing 'on the fly'

This new crankpin grinder can automatically grind, to close tolerances, more crankshafts per hour than you have ever produced before.

In addition to indexing *on the fly*, other *automatic* features giving this machine its higher production are Truform dressing, lateral locating, workrest advance, Microfeed® and sizing.

LANDIS

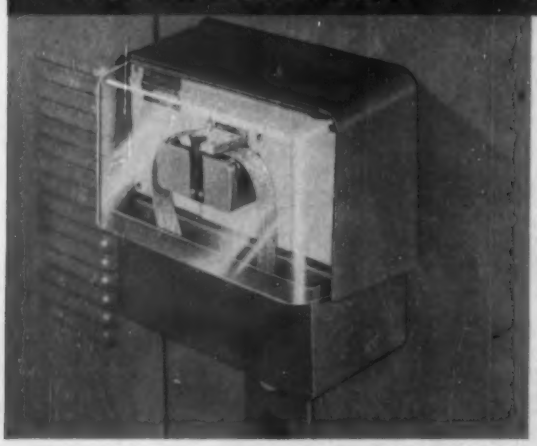
world leader in precision grinders

LANDIS TOOL COMPANY; WAYNESBORO, PA.

NEW-WARNER & SWASEY 1AC SINGLE SPINDLE CHUCKING AUTOMATIC WITH NUMERICAL TAPE CONTROL

CONVERTIBLE IN MINUTES

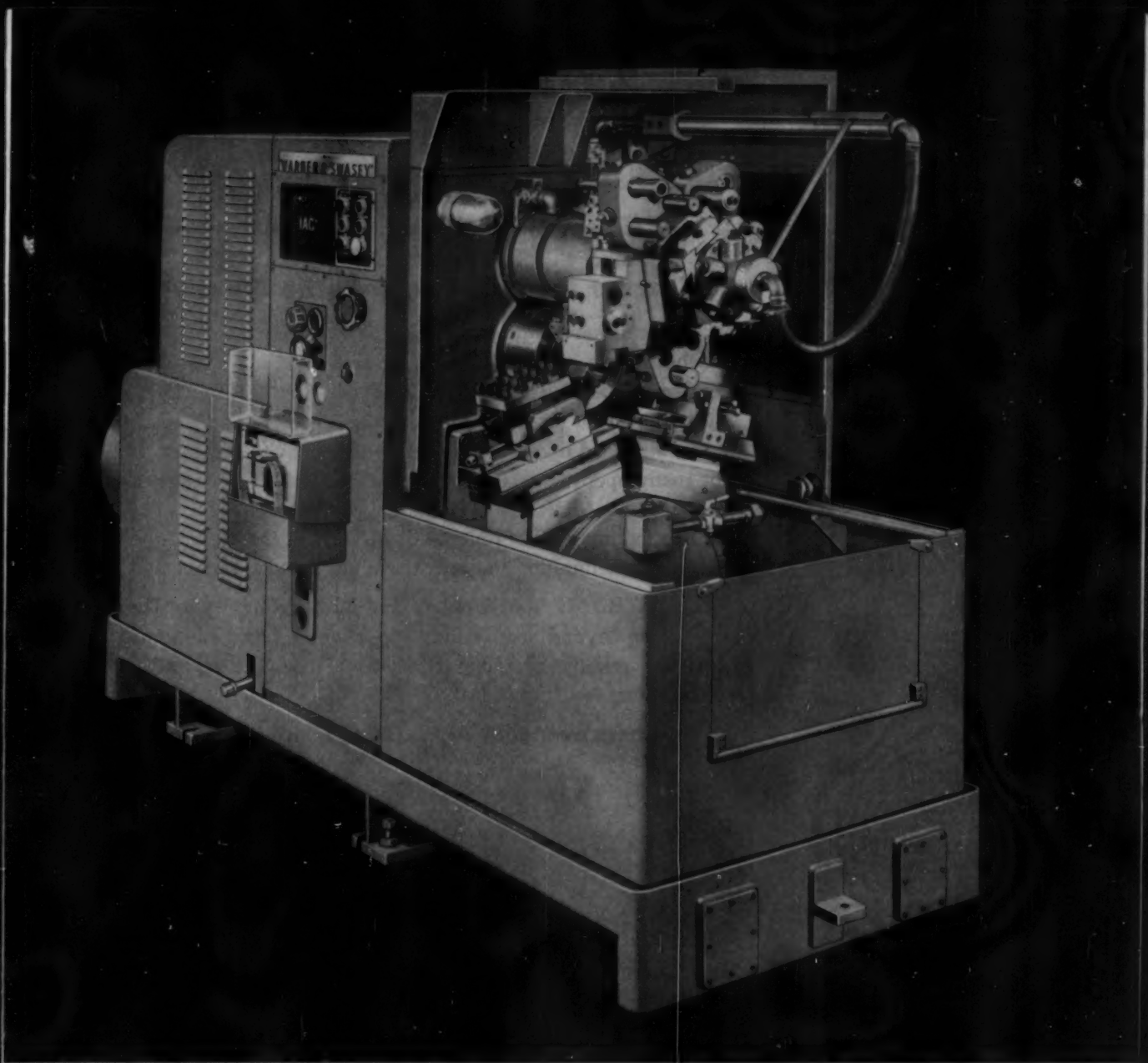
FROM TAPE CONTROL...



Punched tape inserted into this tape reader provides a pre-planned program of standard 1AC automatic functions. This permits an engineered sequence of speeds, feeds and cutting stroke lengths for controlled production efficiency.

TO STANDARD AUTOMATIC CONTROL

When tape control is not desired, standard automatic control of speeds, feeds, cutting stroke lengths can be rapidly set up by the simple placement of numbered trip blocks on the Main Control Drum as shown here.



NOW—you can have all the recognized production advantages of the W/S 1AC Single Spindle Chucking Automatic PLUS Tape Control PLUS Convertibility of Controls that add greatly to day-to-day operating flexibility. It takes but a few minutes to switch from one type of automatic control to the other. The 1AC need never stand idle waiting on the tape for a job. This convertible automatic control feature is particularly beneficial to users just learning the ins-and-outs of tape control. There is no lost production while gaining experience in the preparation of tape, and jobs can be *gradually* converted to tape control.

This machine enlarges your opportunities for handling small and medium size lot work on an automatic basis. Close tolerances—from first piece to last—are routine due to the built-in rigidity and accuracy of these 1AC's. And they have the power and speed to get the most out of advanced cutting tools and methods.

Some other production advantages your W/S Field Engineer can enlarge upon are: complete cross slide flexibility—hand control of automatic functions—single station operation—and a number of others. Warner & Swasey Co., Cleveland 3, Ohio.

You can produce it better, faster, for less . . . with a Warner & Swasey

ARMSTRONG
TOOL HOLDERS

A Correct Tool for Every Lathe Operation

You can save time (and money) by ensuring that your machine tools are equipped with *adequate numbers* of the correct ARMSTRONG Tool Holders. The ARMSTRONG System of Tool Holders includes correctly designed tools for *every* standard operation on lathes, shapers, and planers, and for many operations on turret lathes and screw machines. By utilizing the ARMSTRONG System of Tool Holders, you can reduce tooling costs, eliminate down time in tooling up, operate your machine tools at maximum feeds and speeds.

ARMSTRONG Tool Holders are long-lasting tools. They are strong beyond need, handy and efficient, profitable to use, and are readily available from your local ARMSTRONG Distributor.

Check over your ARMSTRONG Tool Holder needs.
Write for literature.

INDUSTRIAL DISTRIBUTORS
THE RIGHT HAND OF PRODUCTION

If you do not know the name of your local ARMSTRONG Distributor, inquire when asking for literature.

ARMSTRONG BROS. TOOL CO. 5215 W. ARMSTRONG AVE. CHICAGO 46, ILL.

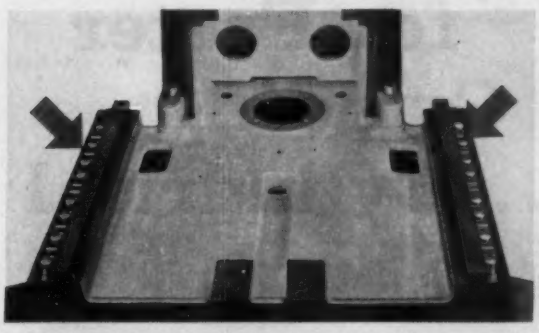
◄ CIRCLE 259 READER SERVICE CARD

▲ CIRCLE 260 READER SERVICE CARD

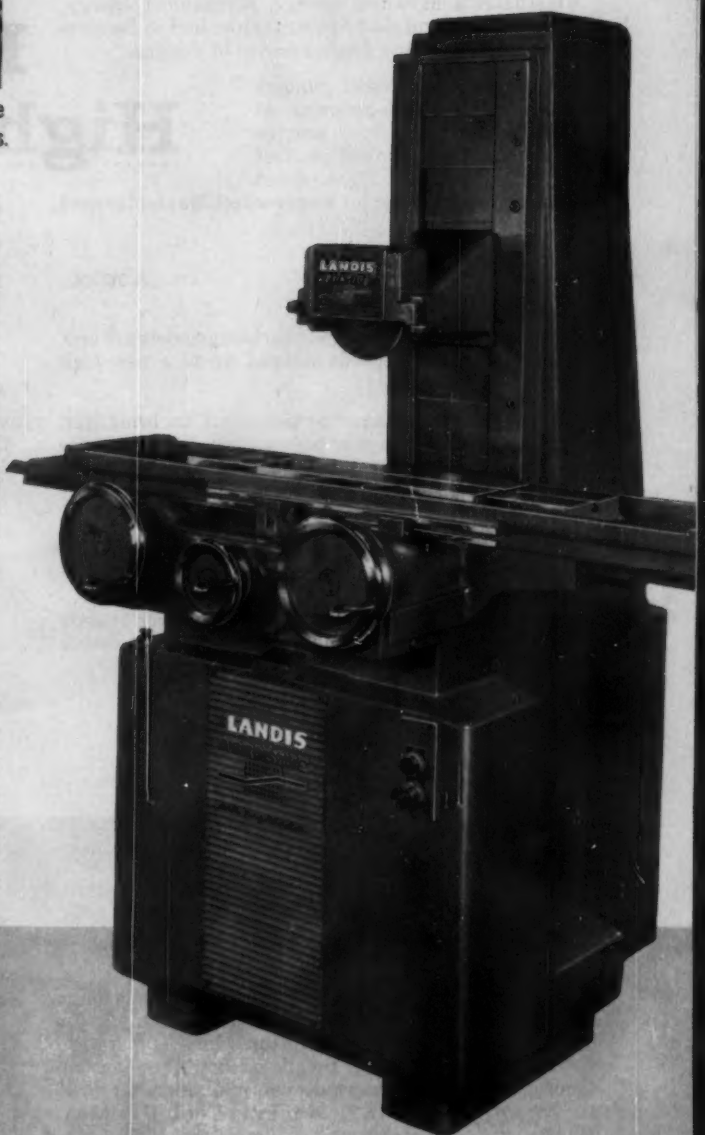
For precision and ease of operation

The only 618 surface grinder with roller bearings on both table and saddle bed ways

Antifriction roller bearings on precision ground table ways give easy operation. Work is always contained between saddle ways.



For maximum accuracy roller bearings on precision ground bed ways minimize the rise and fall caused by oil film build-up.



specifications—Landis Abrasive 618

Worktable capacity	6" x 18"
Standard wheel diameters available	7" or 12"
Capacity under 7" wheel	14½" to table
Capacity under 12" wheel	12" to table
Spindle drive motor: 7" wheel	1 hp
12" wheel	2 hp
Net weight	1,820 lbs.

LANDIS
ABRASIVE
precision surface grinders

Landis Tool Company, Waynesboro, Penna.

From Norton... Higher Speeds for Faster Grinding ...Cylindrical or Surface

For your cylindrical grinding

. . . Norton brings you cylindrical grinders which provide a new higher wheel speed of 8500 SFPM. In test after test Norton Machines using "high-speed" Norton wheels have proved their ability to operate at this new high speed — safely, steadily and with production advantages never obtained before.

These Norton cylindrical production grinders — now called the Series 8500, and so identified with a name plate — include the Type CTU Cylindricals, Angular Wheel-Slide grinders, No. 2 Centerless and the Type CP-1 PLUNG-O-MATIC®. Similarly, Norton high-speed wheels have been tested and approved for 8500 SFPM and carry the new checkered-flag stencil.

Remember: *it took a great deal more than stepping up spindle speeds to assure the greater productivity of Series 8500 machines.*

Fluctuations in wheel energy, mechanical energy, tangential force and many other factors had to be carefully considered before final approval of designs.

As a result, Series 8500 grinders produce more pieces-per-hour at lower cost-per-piece . . . provide finer finishes for improved product quality . . . and their higher speed reduces wheel dressings for longer wheel life and lowered wheel cost.

For your surface grinding

. . . Norton Type S-3 hydraulic surface grinders are now available with table speeds stepped up to a new high of 150 FPM.

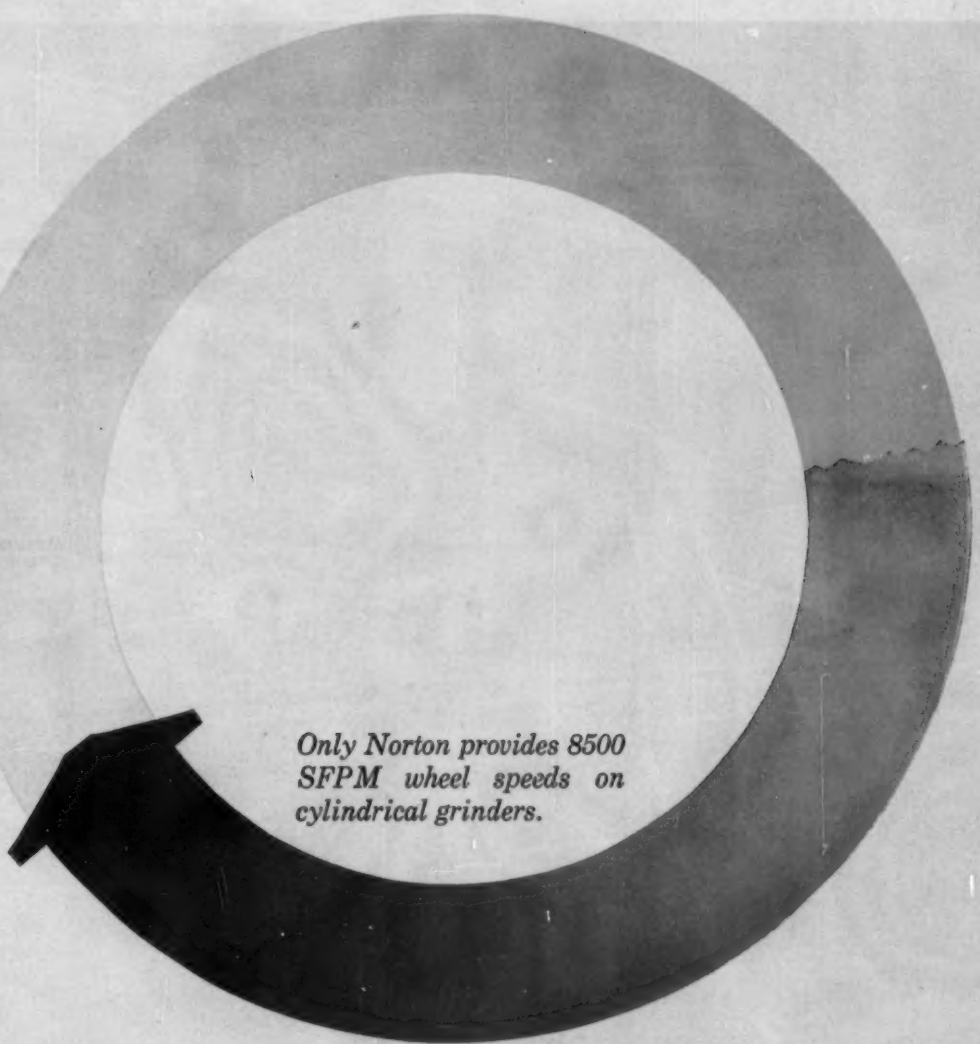
This is another Norton achievement to bring you aster production than ever before. And, like the Series 8500, the Type S-3's are engineered to provide better production and product quality as a benefit of higher table speed.

Available in 6″ x 18″ and 8″ x 24″ sizes, Type S-3 surface grinders are fast and accurate on long production runs or toolroom grinding. They handle taller workpieces . . . are equipped for fast positioning, better sighting and loading . . . and their faster table speeds mean less heat damage to workpieces.

Only Norton provides 150 FPM table speeds on surface grinders.

Learn how Norton developments are bringing more and more advantages of the speed age to many types of grinding. And call your Norton Man — a trained Grinding Engineer — for details on how these advantages can be brought to your own production. Or write to NORTON COMPANY, Machine Tool Division, Worcester 6, Massachusetts.

District Offices: Worcester, Hartford, Cleveland, Chicago, Detroit. *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5.

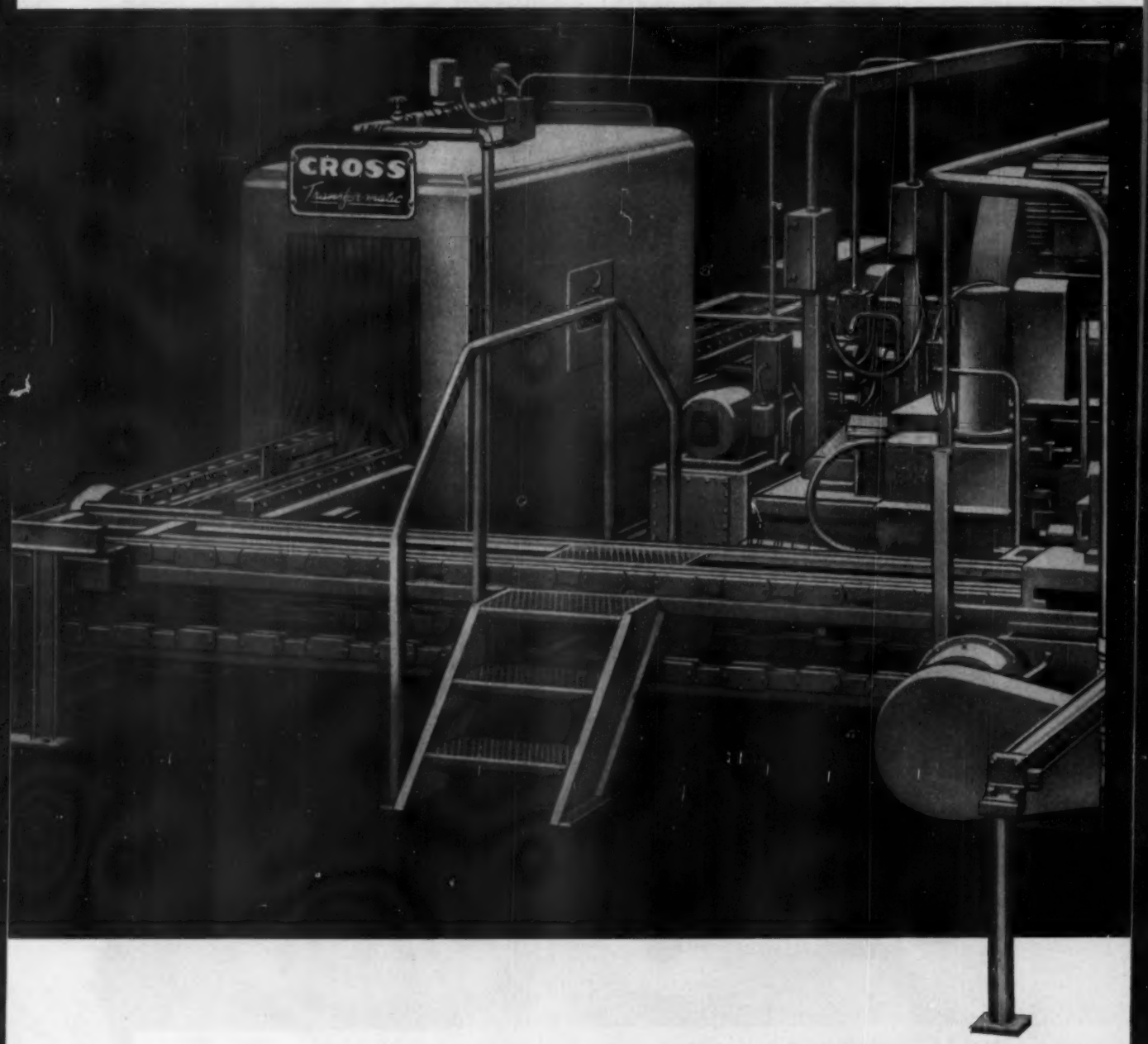


NORTON
MACHINE TOOLS

75 years of... Making better products
...to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Electro-Chemicals — **BEHR-MANNING DIVISION:** Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes
MACHINE TOOL DIVISION: Grinding and Lapping Machines — **G & E DIVISION:** Shapers • Gear Cutting Machines • Gear Induction Hardeners

Completely Machines Tractor Axle Housings



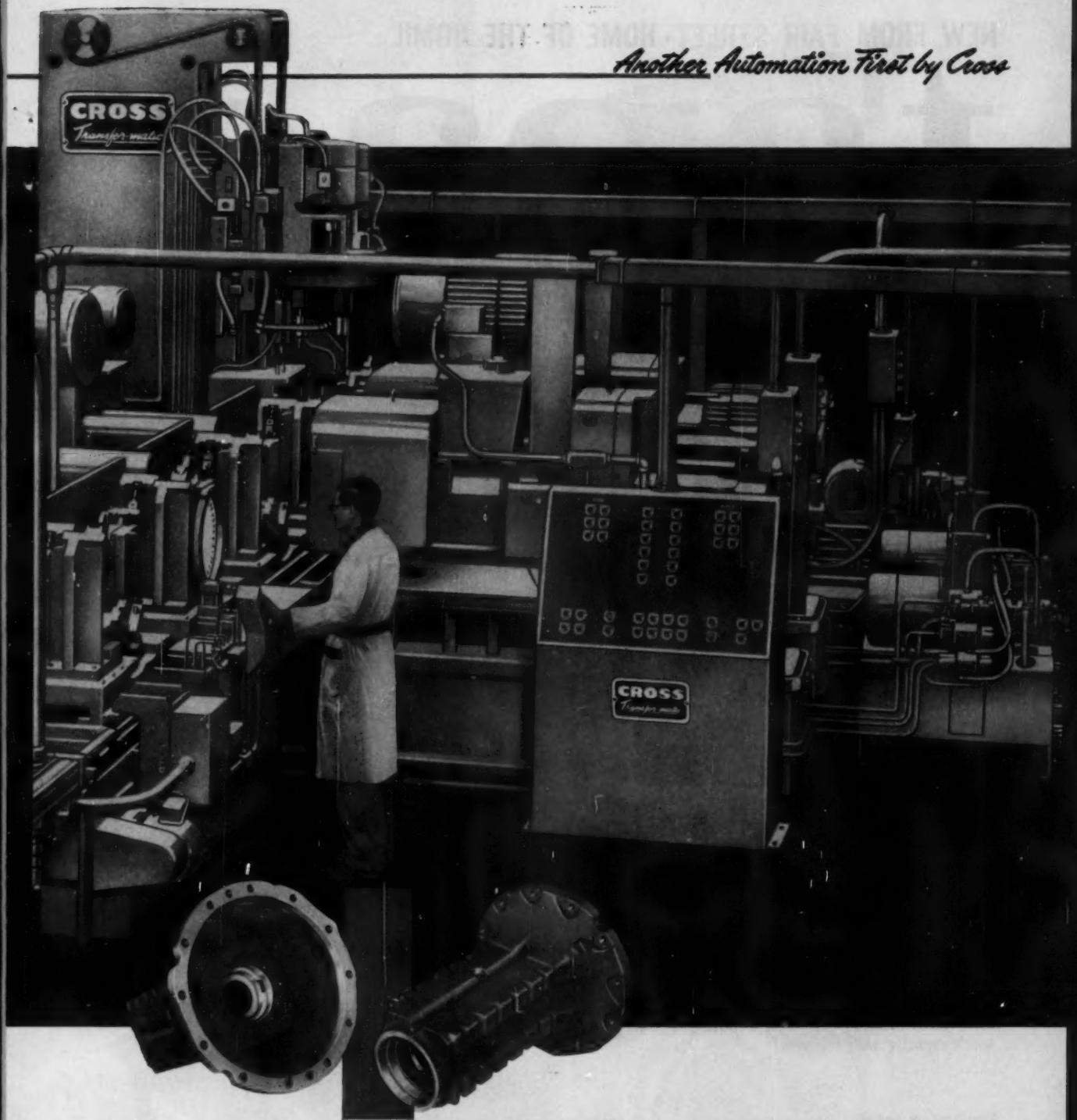
Assures Concentricity and Squareness of Bearing Seats, Counter-Bore and Mounting Flange

A significant breakthrough in processing of tractor rear axle housings has been accomplished by this new Transfer-matic which performs all machining operations.

An outstanding advantage of the machine is greater accuracy. Concentricity and squareness of the bearing seats, counter-bore and mounting flange are assured. Bore tolerances are ±0.0005. The concentricity, squareness, and center-distance tolerances between the bearing seats, faces and dowels is ±0.001. Close alignment between the two ends is maintained by doing all precision boring and the facing on both ends in one station.

CIRCLE 264 READER SERVICE CARD

Another Automation First by Cross



Four different housings weighing up to 175 pounds are processed with minor adjustments. Production requirements are up to 28 per hour for any of the four parts.

An unusual feature of the Transfer-matic is the use of two shuttle heads that index so that successive operations can be performed without moving the part. This design reduces the amount of capital investment required.

A Cross Sales Engineer will be glad to elaborate on these and other Cross developments.

Established 1898

THE **CROSS** CO.

First in Automation

PARK GROVE STATION • DETROIT 5, MICHIGAN

CIRCLE 265 READER SERVICE CARD

NEW FROM FAIR STREET• HOME OF THE JIGMIL

tapac*

tape control system for DeVlieg Spiramatic Jigmils®

IONS • ACCURATE HOLES AND FLAT SURFACES IN PRECISE LOCATIC

Now available for automatic programming of all Spiramatic JIGMILS, Tapac is DeVlieg's own system of numerical control. And it is so simplified, a tool engineer can master the programming technique in 3 to 4 hours.

Designed to make full use of JIGMIL'S inherent accuracy and precision, Tapac is a point-to-point system for automatic measuring, positioning and cycling complete parts programs utilizing 1" eight-channel standard punched tape input. Automatic functions include sequential or simultaneous positioning of vertical and horizontal slides, spindle depth control cycling and control of spindle speeds and feeds. *Automatic positioning repeats to within 0.0001".* The control system is comprised of simple plug-in electronics and standard proven components.

Come to Fair Street and see the Tapac system of automatic tape control for jigless boring and machining in our own production operations. Its accuracy, precision and flexibility will work equally well for you.

*Trademark—De Vlieg Machine Company

Rewarding revelations in automatic precision await your next visit to Fair Street

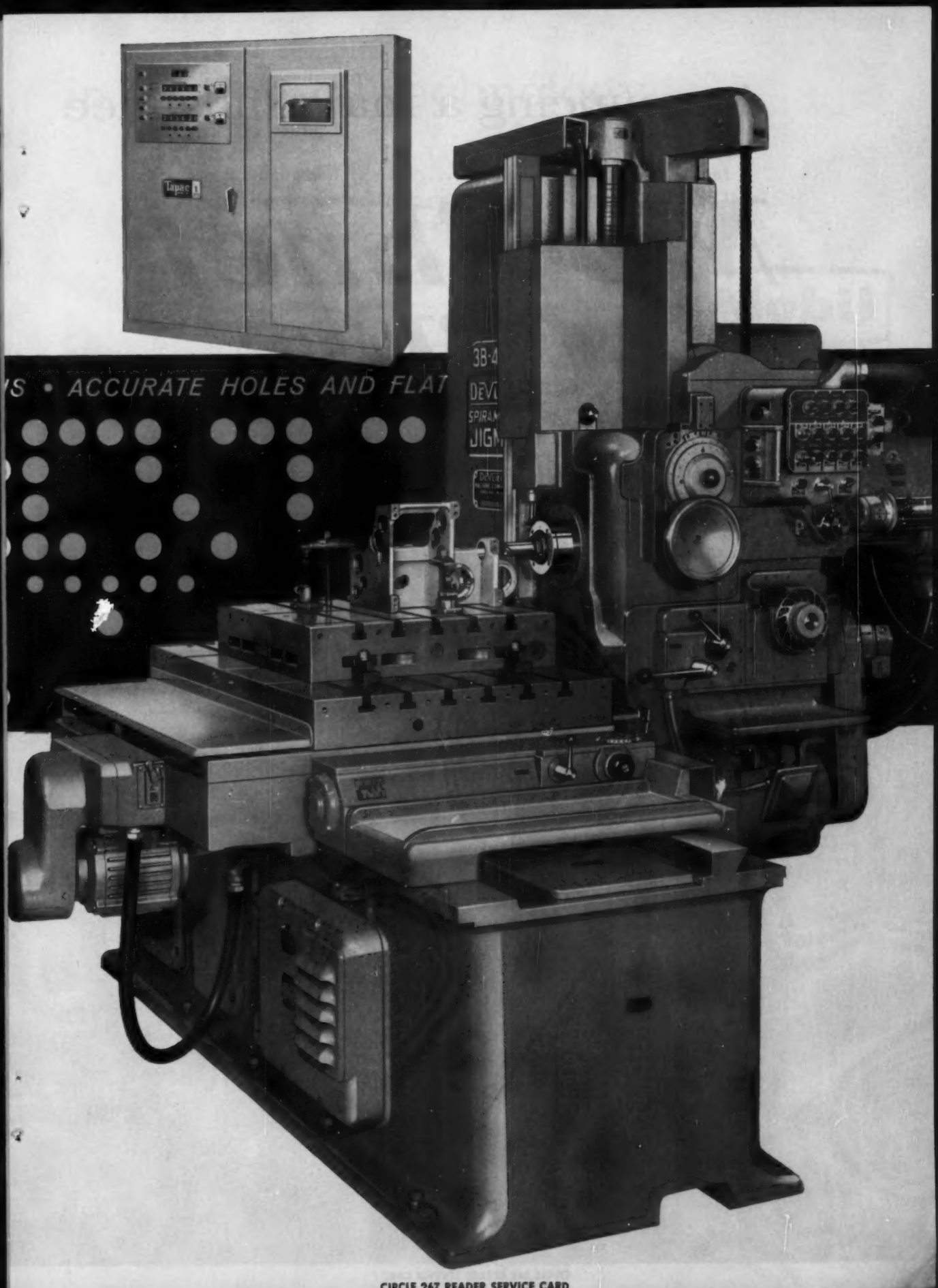
DeVlieg

SPIRAMATIC JIGMILS®

ACCURATE HOLES AND FLAT SURFACES IN PRECISE LOCATIONS

DE VLIEG MACHINE COMPANY, FAIR STREET • ROYAL OAK, MICHIGAN

CIRCLE 266 READER SERVICE CARD



CIRCLE 267 READER SERVICE CARD

Announcing a major advance

Mobilmet Oils

the first multi-metal cutting fluids...
with unique pressure-temperature selective activity.

This Tapping Efficiency Tester is one of many Mobil research tools used in the development of cutting fluids such as Mobilmet . . . effectively evaluates the machining efficiency of cutting oils on soft, draggy SAE 1020 steel. On this difficult machining operation as well as in field service, Mobilmet oils have demonstrated results better than conventional cutting fluids intended for this application. Other applications for new Mobilmet oils include: Turning, Drilling, Boring, Milling, Gear Hobbing, Shaping and Shaving, Threading, Tapping, Pipe Threading, Surface and Internal Broaching, Thread and Form Grinding, Thread Rolling, Forming and Special Automatic Screw Machine Operations.

CIRCLE 269 READER SERVICE CARD

in cutting-oil technology...

Now... from Mobil Research... versatile new cutting fluids that offer you: • greater machine output • lower tool costs • reduced loss from rejects... over wide ranges of metals and operations!

Now, after two years of exhaustive research and field testing . . . new Mobilmet* oils—the first multi-metal cutting fluids ever offered to the metalworking industry.

Mobilmet oils are uniquely versatile . . . help simplify your cutting oil requirements because each grade is effective over ranges of metals and operations beyond the capacity of any conventional product. And Mobilmet oils offer you superior machining results as well—in terms of improved finishes, longer tool life, and reduced staining.

Behind this versatility and effectiveness: a new additive composition, developed and patented by Mobil, which is *pressure-temperature selective* in its activity—highly effective over the wide ranges of cutting pressures and temperatures produced in machining various metals with greatly different physical characteristics. As a result, Mobilmet oils are useful for both tough, draggy metals and hard, brittle metals.

Mobil

Call your Mobil Representative, or use the coupon below.

*Mobilmet is a trademark of Socony Mobil Oil Company, Inc.

MOBIL OIL COMPANY, 150 East 42nd Street, New York 17, N. Y.

Mobilmet oils offer superior tool life on both soft, draggy metals and hard, clean-cutting materials. These pipe threading chasers used for six weeks in moderately severe job-shop service show little wear on either tool faces or thread crests. Results were achieved with heavy-duty Mobilmet oil.

Since they effectively control built-up edge and tool wear, Mobilmet oils provide superior finishes that meet exacting specifications—with fewer rejects, and in some cases reduced necessity for additional finishing operations.

Stain-inhibiting effect of new additive combination is demonstrated with two steel plates. Plate on the left was immersed in conventional corrosive cutting oil; plate on the right was immersed in heavy-duty Mobilmet grade intended for the same application. Re-polished tops of plates show original condition.

Mobil Oil Company, Room 2857-A
A Division of Socony Mobil Oil Company, Inc.
150 East 42nd Street, New York 17, N. Y.

Gentlemen: I am interested in learning how Mobilmet oils can improve metal-cutting operations at my plant. Contact me about setting up an evaluation program.

Name_____

Position_____

Company_____

Address_____

City_____ State_____

CIRCLE 268 READER SERVICE CARD

How George Deickert upped grinding

Watchmakers have nothing on the builders of Marion power shovels as far as accuracy is concerned. Some of the shafts on Marion's biggest shovel (two full carloads in a single scoop!) have to be finished to a tolerance of ±.0004" on bearing surfaces.

The sheer size of these grinding jobs staggers the imagination too. The steel shafts run up to 12 ft. long and 14" in diameter so a tremendous amount of metal has to be removed and the grinding operation accounts for a substantial chunk of costs.

That's where an outstanding Tool Control Supervisor like Marion's George Deickert is worth his weight in dollar bills. His analysis of the situation showed five major deficiencies in the wheels used for the job and he wasted no time turning dissatisfaction into action. He called in Bay State Abrasive Specialist Dick Crofoot and went over the whole problem with him in detail. Crofoot went to work with the engineering staff at Westboro and came up with a specification that did both grinding and finishing *and* ensured: (1) 30% faster stock removal. (2) Excellent instead of poor size control . . . *easily within* the ± .0004" tolerance. (3) Consistent finish at 20 RMS. (4) 50% less dressing. (5) Greatly improved wheel life. (6) Consistent duplication of performance, wheel after wheel.

As George Deickert himself says: "This isn't the only job that Bay State has done well on for us. We have dozens of different types of grinding jobs . . . and we use a great many different types of wheels, including tool wheels. Bay State not only does a lot of jobs for us and does them well . . . they have also been able to duplicate excellent first performances with their follow-up wheels."

If your grinding operations . . . large, small or microminiature . . . are less than 100% efficient by current standards of abrasive technology, your Bay State distributor or direct representative is thoroughly trained and fully equipped to work out practical improvements for you. *Better grinding at lower cost . . . that is his business.*

One of the biggest excavators ever built, Marion Power Shovel Company's Type 5761 "Stripmaster" can dig 65 cu. yards at a time, fill two railroad cars with a single dipperful.

George Deickert, left, Tool Control Supervisor, and Melvin A. Griffith, grinding machine operator — Marion Power Shovel Co., Marion, Ohio — check progress of large, high carbon molybdenum steel shaft being ground by a Bay State cylindrical grinding wheel.

speed 30% and cut dressings by 50% at MARION POWER SHOVEL

George Deickert's background is impressive to put it mildly. His technical training started in Germany with a Masters Degree in steam and combustion engineering from Berlin University. His business career includes hitches with United Carbon Co., and Weston Instrument Co., in Newark, N. J. and fifteen years with Curtiss-Wright in Patterson, N. J. Starting as a Methods Engineer, he's been with Marion Power Shovel since 1947. He has used Bay State wheels since 1932 and says they have never let him down.

BAY STATE ABRASIVES

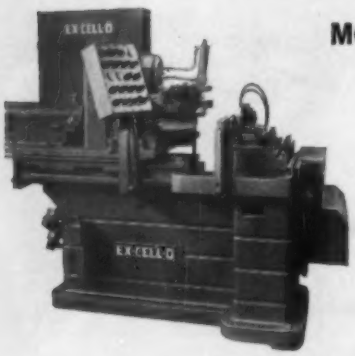
BAY STATE ® WHEELS of PROGRESS

Bay State Abrasive Products Co., Westboro, Massachusetts.
In Canada: Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.
Branch Offices: Chicago, Cleveland, Detroit, Los Angeles, Pittsburgh. *Distributors:* All principal cities.

NEW! Ex-Cell-O Boring Machines

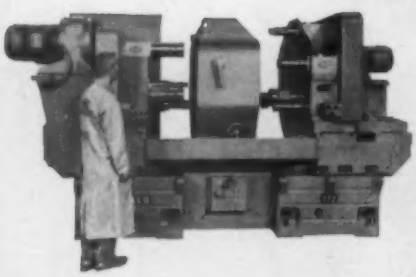
A Size, a Type, a Model to Fit Every Production Need!

From subminiature bearing races to giant transmission housings—whatever the work, there's a standard Ex-Cell-O engineered and built to do the job with the performance of the costliest custom equipment!



MODEL 308 PRECISION CAM BORING MACHINES

For production parts requiring close-tolerance contouring, boring, turning, facing and grooving (singly or in combination), Ex-Cell-O Models 308 and 312 (for larger workpieces) feature the precise repeatability only direct cam control of table and cross slide can offer. Fast, easy cam-changing makes these models ideal for short runs at high production rates.



MODEL 772 HORIZONTAL BORING MACHINES

Accuracy, heavy cuts and good finishes on large parts are the high-production characteristics of the Ex-Cell-O Model 772. This dual bridged machine, the largest standard horizontal boring machine in the Ex-Cell-O line, is designed for maximum cycle efficiency and features rugged construction, infinite feeds, and thrust load compensation.

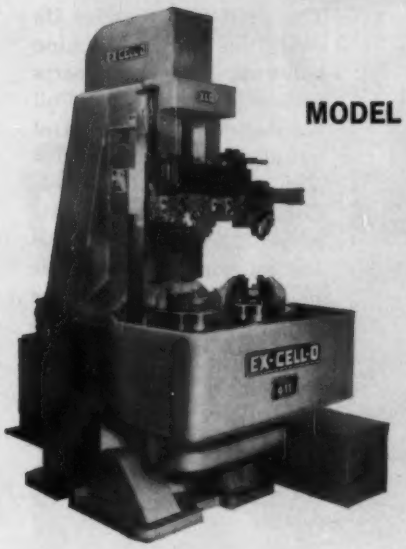
A single-end companion machine, Model 771, is also available.

MODEL 712 MULTIPLE SPINDLE PRECISION BORING MACHINE

Full machine utilization is made possible by the easily-changed multiple-spindle plates featured on Ex-Cell-O's Models 712 and single-end 711. Built-in cross slide permits indexing between bores or sets of bores, and the fully automatic cycle assures maximum efficiency on multiple hole precision boring operations.

CIRCLE 272 READER SERVICE CARD

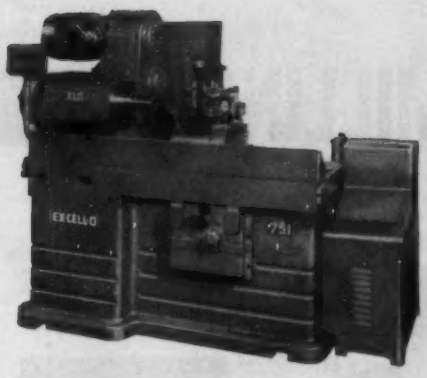
for Production Efficiency



MODEL 411 VERTICAL PRECISION BORING MACHINE

Versatility is the production feature of the new Model 411 Ex-Cell-O Vertical Precision Boring Machine. Easy tool changing and safe, easy, loading of heavy parts also contribute to the on-the-job efficiency of this single-column precision machine. Seven different arrangements of components are possible for maximum versatility.

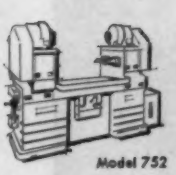
MODELS 731, 732, 751, 752 HORIZONTAL PRECISION BORING MACHINES



Maximum dimensional stability under all kinds of operating conditions, and accurate repeatability on boring, turning, facing, counterboring, chamfering recessing and trepanning operations are the forte of this new line of Ex-Cell-O Standard Precision Boring Machines.

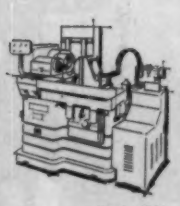
Some of their features: Temperature controlled and insulated mounting of hydraulic control panels . . . extremely rigid bases and tables . . . hydraulic and coolant systems externally mounted . . . new Ex-Cell-O standard and tapered roller bearing spindles . . . manual or automatic operation . . . flexibility to permit use in automated production lines.

Contact your Ex-Cell-O Representative or write direct for details.



Model 752

Model 732



Model 731

60-67

EX-CELL-O FOR PRECISION

PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • TORQUE ACTUATORS • CONTOUR PROJECTORS • GAGES AND GAGING EQUIPMENT • GRANITE SURFACE PLATES • COMPUTER PRODUCTS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • ATOMIC ENERGY EQUIPMENT • DAIRY AND OTHER PACKAGING EQUIPMENT

Machinery Division

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

CIRCLE 273 READER SERVICE CARD

FOSMATIC N/C TURRET DRILL

The drill that carries its own "tool crib". Machine hundreds of different parts without changing tools. Full 3-dimensional tape control including rapid tool selection with the 32-spindle turret. Combined General Electric Mark II and Fosmatic numerical control makes this unique, heavy-duty machine an efficient producer for drilling-tapping-milling with lot sizes as small as one!

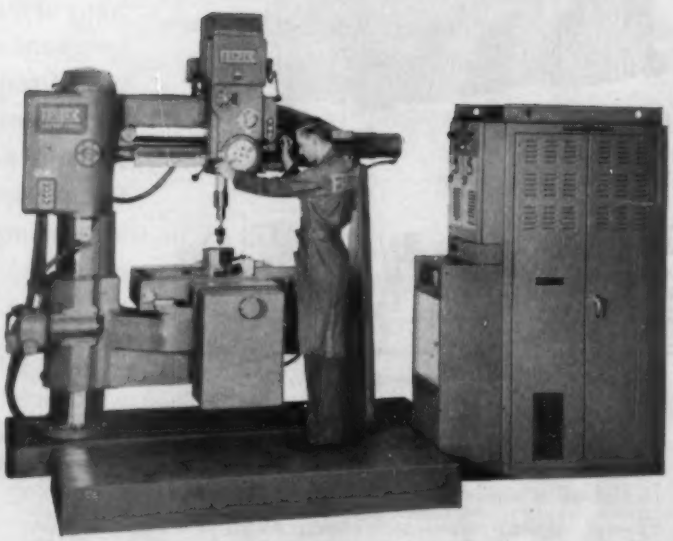
NUMERICAL CONTROL *for more effective, lower cost*

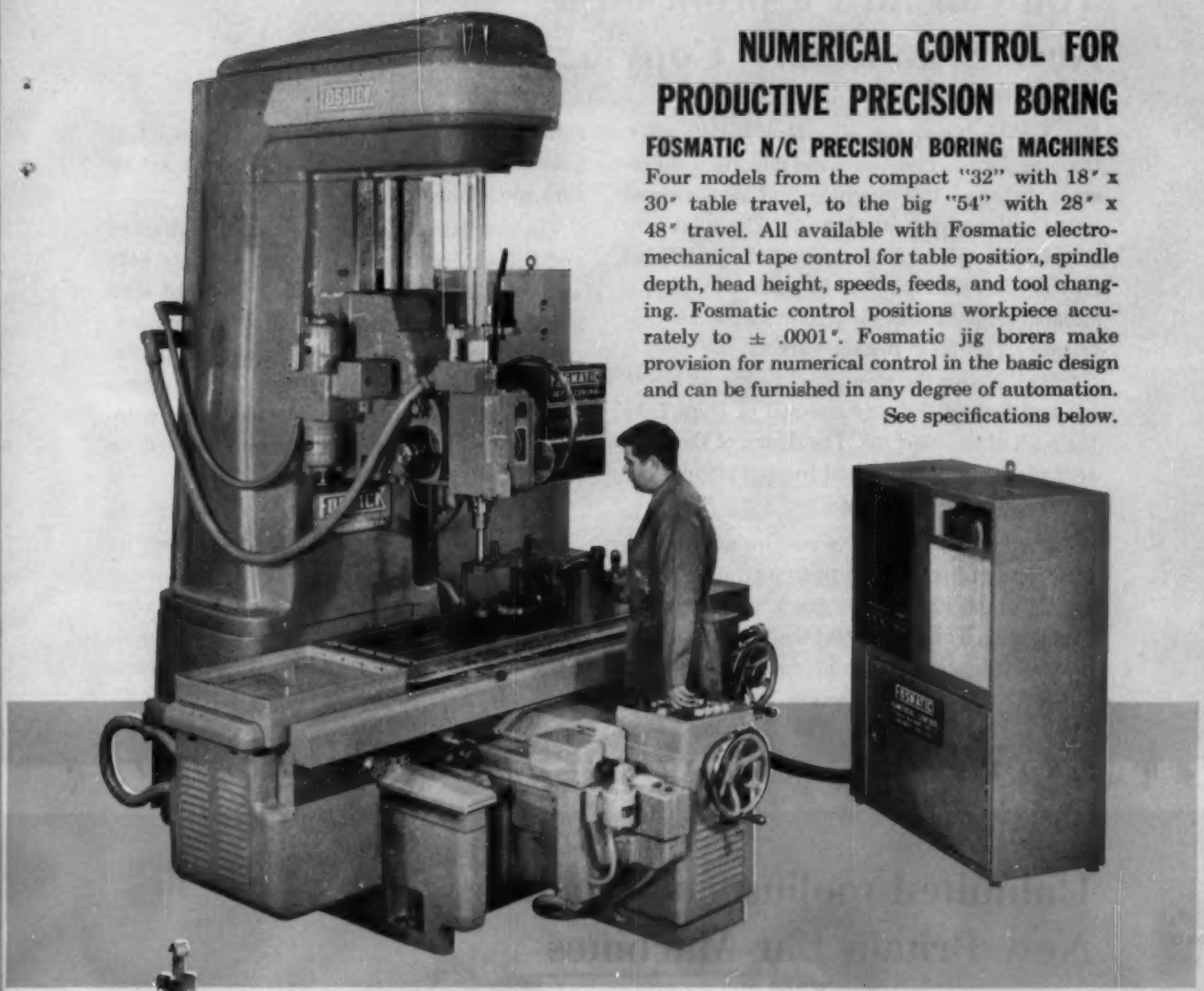
DRILLING • TAPPING • MILLING

Get a proposal from FOSDICK

FOSDICK N/C LAYOUT DRILL

Keep costs low with this economical machine built to speed drilling and tapping jobs through your shop. Great versatility. Simple in concept, easy to operate. Proven, fast General Electric Mark II numerical positioning control, with full zero offset. The best buy in numerically controlled drills.





NUMERICAL CONTROL FOR PRODUCTIVE PRECISION BORING

FOSMATIC N/C PRECISION BORING MACHINES

Four models from the compact "32" with 18″ x 30″ table travel, to the big "54" with 28″ x 48″ travel. All available with Fosmatic electro-mechanical tape control for table position, spindle depth, head height, speeds, feeds, and tool changing. Fosmatic control positions workpiece accurately to ± .0001″. Fosmatic jig borers make provision for numerical control in the basic design and can be furnished in any degree of automation.

See specifications below.

SPECIFICATIONS: FOSDICK NUMERICALLY CONTROLLED MACHINES

	N/C TURRET DRILL	N/C LAYOUT DRILL	N/C PRECISION BORING MACHINES (Jig Borers)			
			Model 32	*Model* 42	*Model* 44	*Model* 54
Table working surface, in.	18 x 31	24 x 42	18 x 32	18 x 42	44 x 22	54 x 22
Table travel, in.	18 x 24	18 x 32**	18 x 30	20 x 36	22 x 42	28 x 48
Spindle nose to table, in.	3 - 23	3 - 23½	4 - 22½	4 - 28½	6 - 30	6 - 30
Spindle center to column, in.	19½	9 - 43	16½	16½	18½	18½
Head or knee travel, in.	12	16½	9½	15½	15	15
Spindle travel, in.	8	12	9	9	9	9
Spindle speeds, rpm	65 - 2500	75 - 1500*	62 - 3000	62 - 3000	30 - 1800	30 - 1800
Spindle feeds, ipr	.0006 - .012	.004 - .020*	.0005 - .015	.0005 - .015	.0005 - .015	.0005 - .015
Motor hp.	3	3	3	3	3	3
Numerical control	GE Mark II —Fosmatic	GE Mark II	Fosmatic	Fosmatic	Fosmatic	Fosmatic

*other ranges available **travel of head on arm

The Fosdick Machine Tool Co., Cincinnati 23, Ohio FOSDICK

You can turn a profit on a New Britain +GF+ Copying Lathe

Here's a birdseye view of a New Britain +GF+ Copying Lathe. It shows some important differences between this machine and conventional lathes with copying attachments. The point here is this—*the most effective use of the single-tool copy-turning principle can be made only with a machine designed from the ground up for this type of work.* The New Britain +GF+ is just such a machine. Notice the chip pan. It's big (it has to be) and located for easy removal of chips from the back of the machine. The design of the work area allows for unobstructed free-fall of chips out of the way and into the pan.

The New Britain +GF+ is massive and rugged, with plenty of power—up to 40 h.p., if you need it. It's simple to operate, quick to set up and change over. The single-point tool can be changed in one minute and it out-produces gang tooling setups in the bargain. Turning is controlled by either a template or a prototype. External and internal copying are accomplished in one set-up with special tooling.

The possibilities for short or long run chucked and between centers work on the +GF+ are wide and varied. Because the work is produced with good surface finish and dimensional accuracy, grinding can be reduced and, in some instances, eliminated. Large diameters are broken down economically by successive parallel cuts, automatically if desired, with optional two-cut or multi-cut recycling.

You've got to see one of these machines in action to fully understand the kind and quantity of work they are capable of producing. Contact your New Britain Representative for demonstration arrangements or write The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

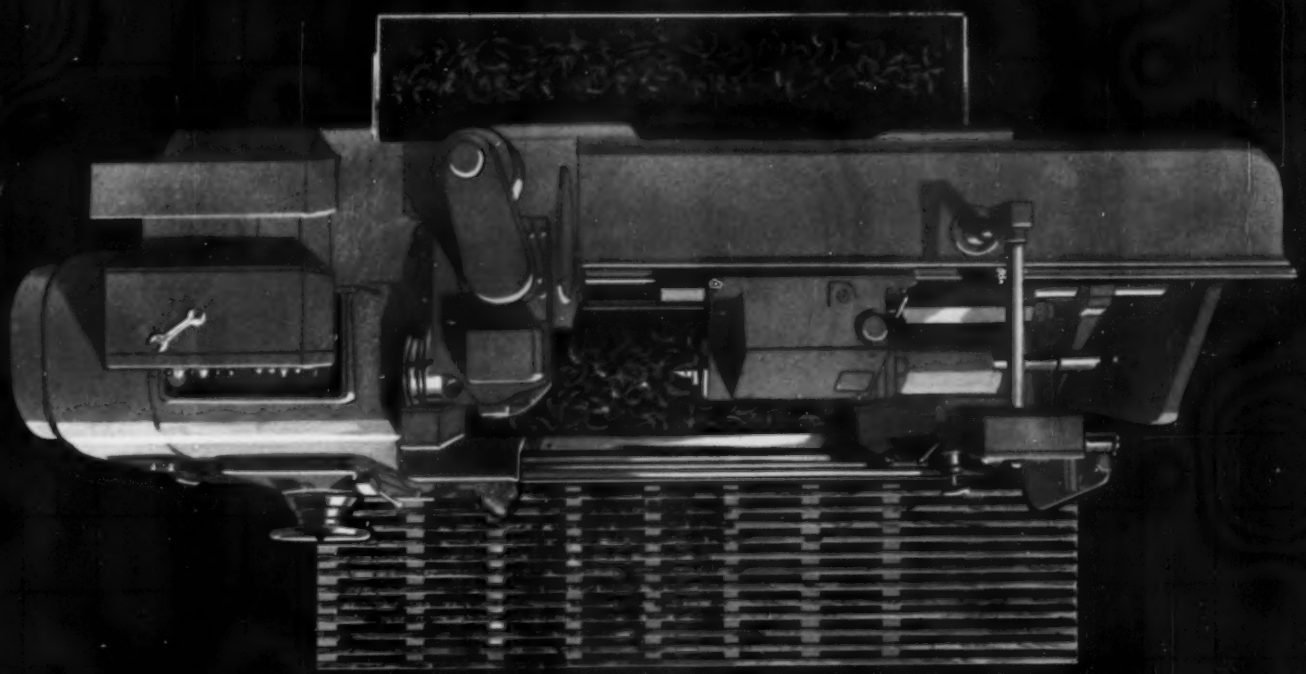
NEW BRITAIN - GRIDLEY MACHINE DIVISION

Unlimited tooling combinations with New Britain Bar Machines

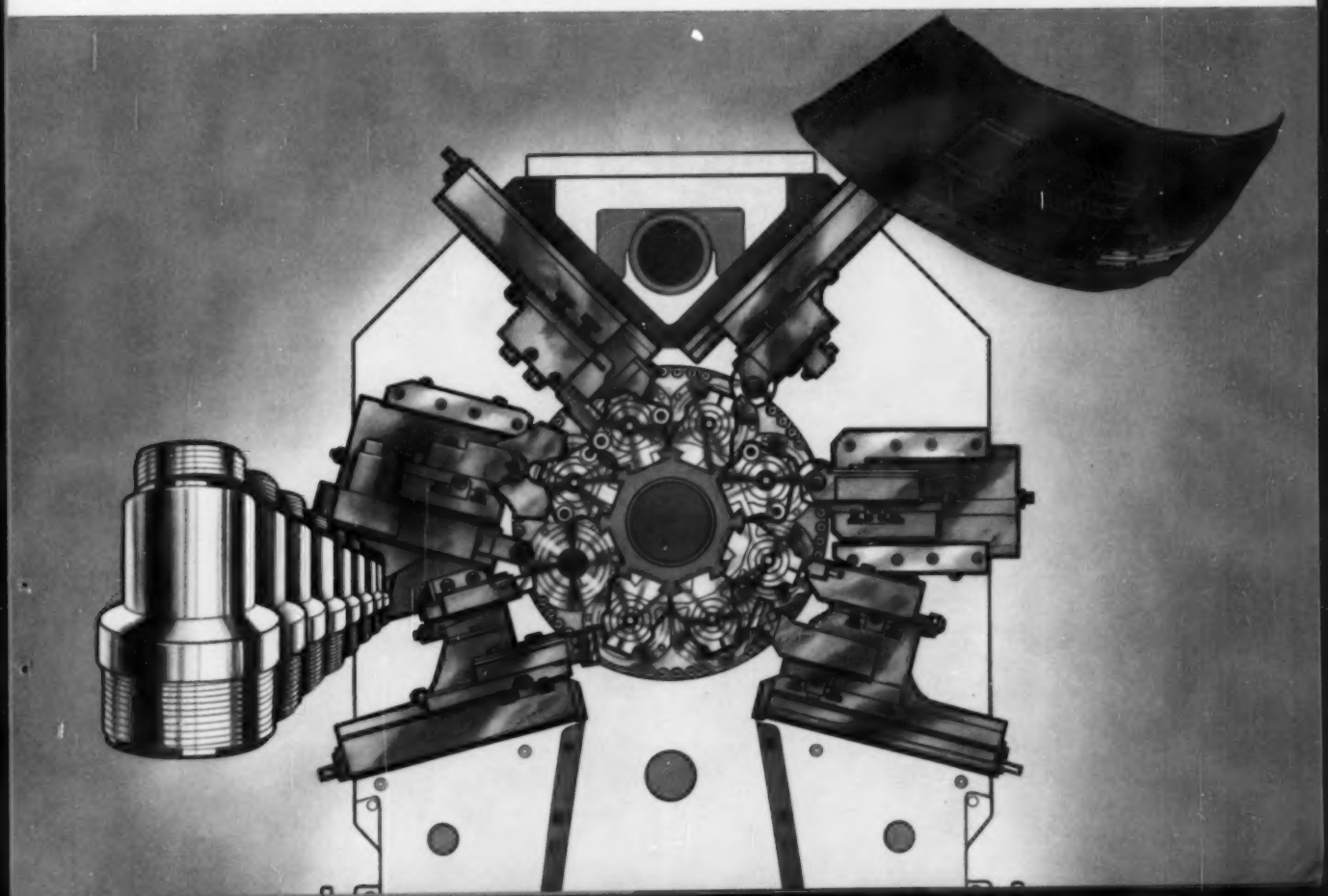
Nothing can out-date your operation quicker than better machines in the hands of a competitor. In the race to keep ahead on quality, price and delivery, nothing can put you out front faster than machines capable of consistently producing the highest quantity of finished pieces at the lowest possible cost. New Britain's new series of bar machines represents in every way the most advanced bar-turning units available. Each of the four-, six- and eight-spindle models has been redesigned, adding new features and improving older ones. Unlimited cross slide and end-working tool combinations, extremely fast operation (even on stainless) and a variety of models and features to choose from add up to some good reasons for incorporating New Britains into your replacement or production expansion plans.

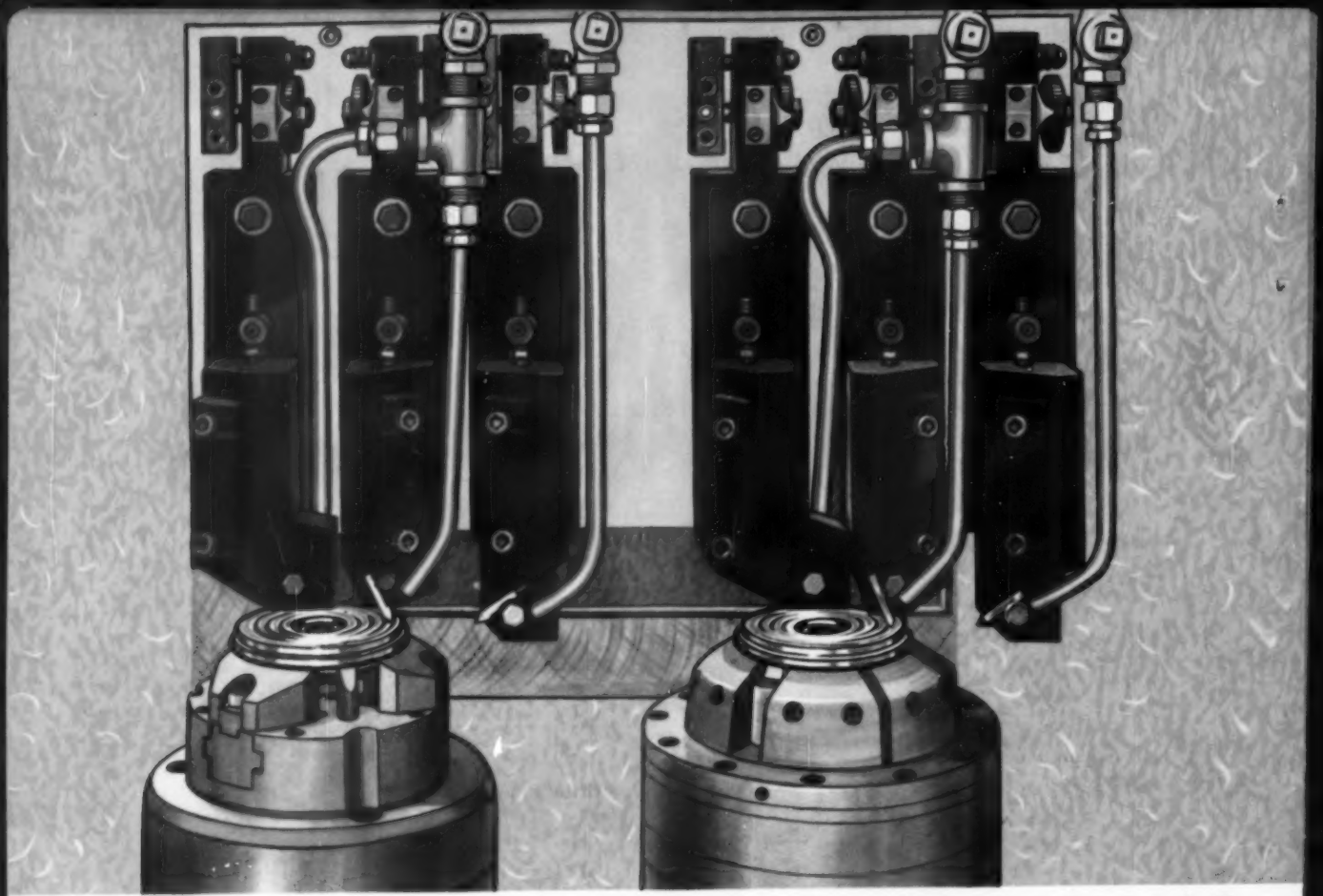
The eight-spindle model is the largest, most modern eight-spindle bar machine available. It has a stock capacity of up to 2⅝" and provides six independently-operated cross slides. As with all New Britain bar machines, the operations of the cross slides and end-working tool slide are disc-cam controlled for positive actuation, close tolerance machining and easy, rapid change-overs.

This is only a very small part of a story that is bound to interest you. The whole story and its significance in terms of your profits is available from your New Britain Representative. If you prefer, contact us directly at The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

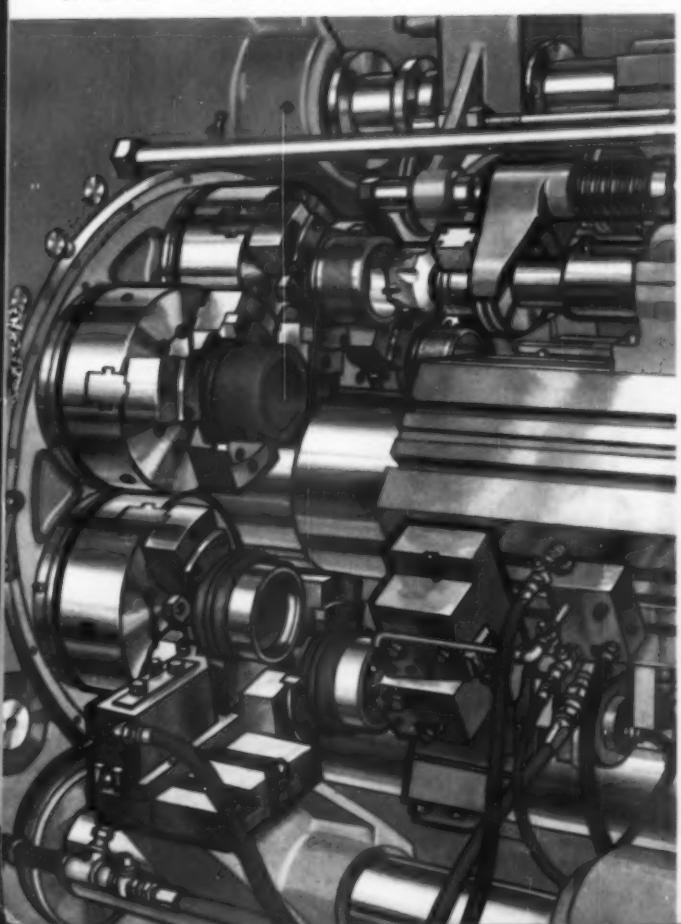


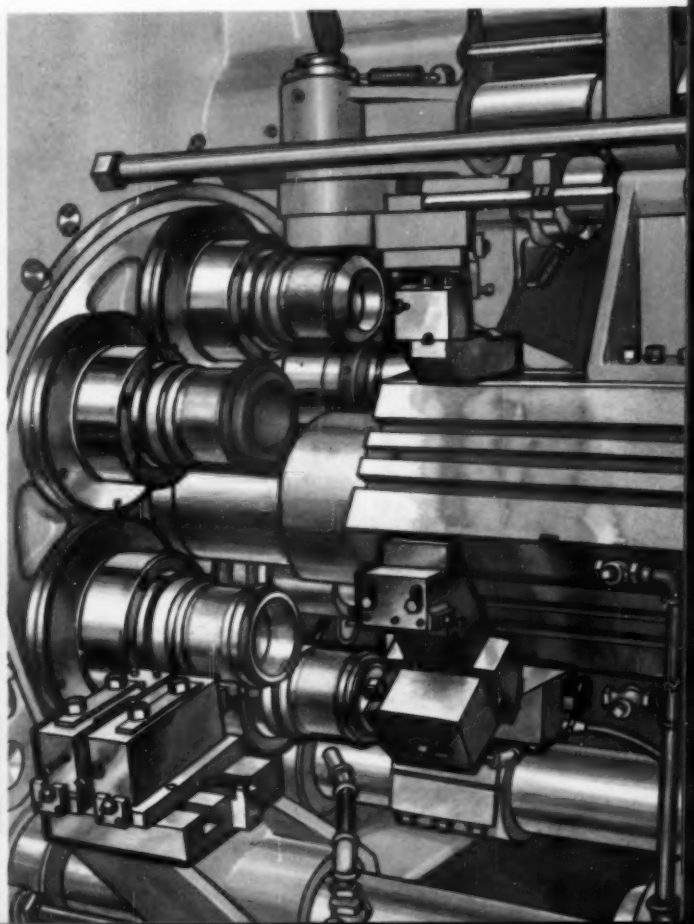
THE NEW BRITAIN MACHINE COMPANY





NEW BRITAIN - GRIDLEY MACHINE DIVISION





New Britain's new concept for contour turning and boring

Beyond a certain point, continued refinement of existing designs in machine tools ceases to make an appreciable contribution to performance. Thus in designing our New Series of Vertical Precision Boring Machines, we have incorporated several completely new design concepts to provide improved performance and greatly increase over-all usefulness.

For the first time machines of this type can be used as building block units. Their clean-sided design permits any number of self-contained machines, each with one or more spindles, to be arranged side by side and operated as a single unit. They also may be operated with equal efficiency as individual machines. Parts can be inverted on adjacent machines or on adjacent spindles of the same machine.

In order to take the fullest advantage of the precision inherent in cam control, long linkages between cams and slides have been eliminated. A pair of cams is mounted on a common shaft which is carried *within the vertical slide.* Since all slide actuating forces are contained in the vertical slide, both cams are directly adjacent to the slides they control and no outside forces are imposed on the slide ways. The result is maximum rigidity for heavy cuts coupled with extreme accuracy for close tolerance work.

This unique and eminently workable approach to contour turning and boring results in the highest order of accuracy on even the most complex pieces. Your New Britain Representative can give you details on the nine different models available in this series. For catalog material, write The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Conn.

THE NEW BRITAIN MACHINE COMPANY

New Britain . . . still the best Chucker you can buy

We're not unhappy about the fact that for years, in many plants, the name New Britain has been synonymous with chuckers. New Britain Chuckers have turned out literally millions of pieces of work for practically every major industry in the world. This is less important to the prospective buyer of one of these machines, however, than the capabilities of these machines today. How do they stack up against other chuckers or even other types of machines capable of doing similar work? Pretty well, we think.

New Britain's open-end design still can't be beat for unlimited accessibility to the tooling area. This same wide-open feature makes it doubly more practical to adapt these machines to automatic loading and unloading.

The unusual combination of longitudinal and transverse forming motions is another unbeatable New Britain feature. The massive forming arms on New Britain Chuckers allow heavier cuts and cuts of much greater complexity. This ability to do more work can eliminate the need for second operation machines in many instances. For really complex work, two chuckers set up side by side, as shown here, each doing one side of the piece, can smooth the way for high production. Less complicated work can be set up to perform both sides of the same piece on a single machine.

These massive machines provide the tooling combinations, spindle speeds and power to perform the widest possible variety of work. Their basic design will stay new for years to come, continuing to provide profitable operation. You may know New Britain Chuckers, but you may not be fully aware of the improved series presently being offered. Why not call your New Britain Representative or contact us at The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

Quick delivery of the Drive you need!

Typical final assembly of A-S Drives from completed sub-assemblies

When you purchase a Square D **A-S Drive**, you get a complete "package"—including drive motor, operator's station and all controls. You also get these important advantages:

QUICK DELIVERY • Square D's unique method of stocking sub-assemblies means quicker deliveries of packaged drives to meet your requirements.

EASY INSTALLATION • Maintenance manuals are complete in every detail, including step-by-step installation instructions. Moreover, each **A-S Drive** is completely factory-tested and adjusted when shipped — only a few trimming adjustments are needed to put it in operation.

MINIMUM MAINTENANCE • Industrially rated components are used throughout, and extra-sturdy cabinets give lasting protection. Static elements and encapsulated circuits—which are virtually maintenance-free — are utilized wherever possible.

EXTRA SAFETY • Only push buttons with heavy-duty construction and potentiometers with industrial clearances are used in operator's stations, for maximum personnel safety.

WIDE VARIETY AVAILABLE • There's a Square D "package" for *any* adjustable-speed job. You can choose from electronic, magnetic amplifier or motor-generator types — with ratings from 1/20 to 400 hp — and with accuracies to within fractions of 1%.

FIELD APPLICATION HELP • Square D has wide experience in the design and manufacture of adjustable-speed drives, and field specialists are trained to help you in the selection of the proper drive.

Write FOR BULLETIN • *Square D Company, 4041 North Richards Street, Milwaukee 12, Wisconsin*

SQUARE D COMPANY

wherever electricity is distributed and controlled

WANTED

the toughest wear problem known for

CARMET CARBIDE

• the hardest metal known •

*****If you've got a real wear problem, it's time you take a long, hard look at Carmet Cemented Carbides . . . and how they can extend operational life and reduce costs.

Carmet Cemented Carbides possess the perfect combination of extreme hardness, strength, and abrasion resistance for the battering that wear parts must take . . . the rubbing, scrubbing, sliding, and scraping.

Carmet Cemented Carbides have a compressive strength higher than any metal or alloy . . . cast, rolled, or forged. They are the hardest man-made metal . . . next to a diamond in hardness, yet far tougher . . . three times stiffer than steel, and up to 100 times more abrasion resistant.

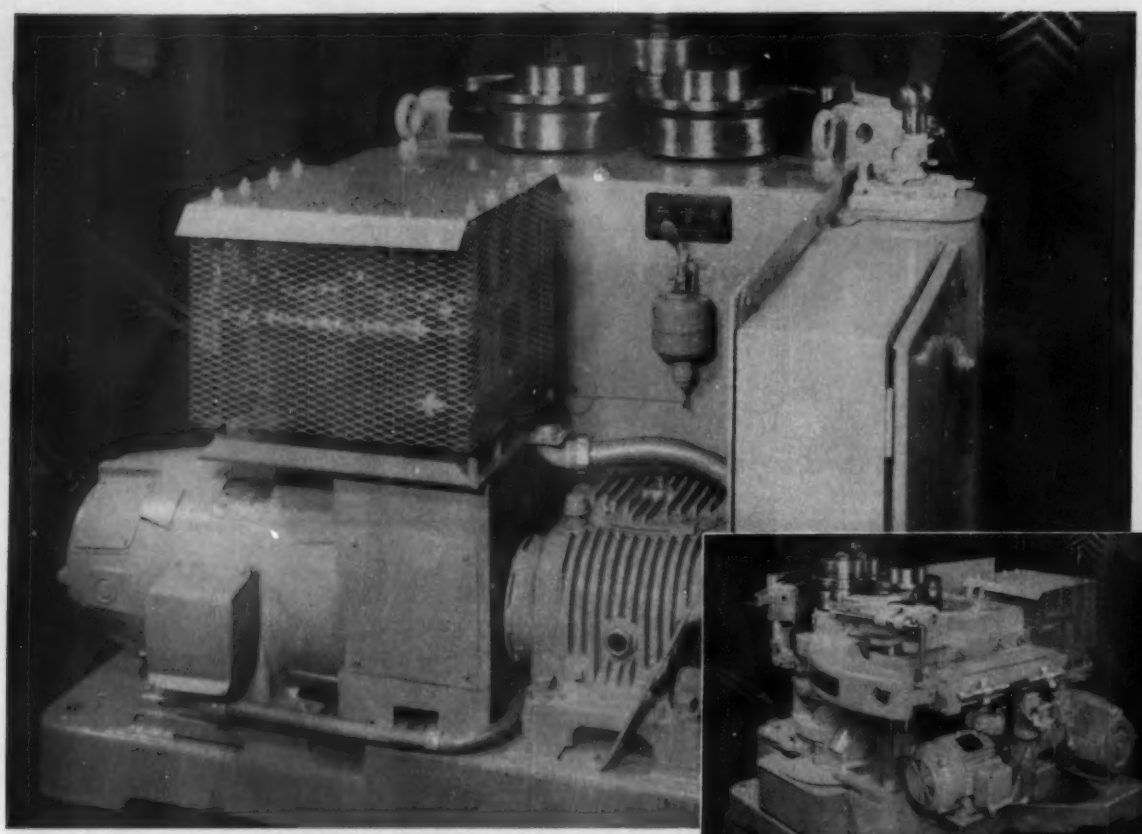
And you can put this hardness and wear resistance where it will do the most good. Carmet wear parts can be made in practically any shape . . . adapted to any function.

For all the facts on carbide wear parts, get Carmet's new booklet on design for wear resistance. It's packed with charts, graphs, case histories, and special design criteria for top wear parts performance. Ask your local A-L representative for a copy, or write: *Allegheny Ludlum Steel Corporation, Carmet Division, Oliver Building, Pittsburgh 22, Pennsylvania. Address Dept. AM-12.*

1095

CARMET® AL

CEMENTED CARBIDE • DIVISION OF ALLEGHENY LUDLUM



New No. 1 Horizontal Bending Roll

Note Hydraulic Roll Adjustment

SPEED DIE-LESS COLD METAL BENDING WITH IMPROVED 'BUFFALO' BENDING ROLLS

- *Fast* Production Bending of Circles, Arcs and Spirals to Commercial Accuracy.
- *Hydraulic* Roll Adjustment Speeds Setup Time.
- *New,* Compact Design Saves Valuable Floor Space.
- *Handle* Angles, Rounds, Squares, Tubes, Pipes, Flats and Special Shapes.
- *Easily* Changed Rolls Eliminate Need for Expensive Dies.
- *Models* and Sizes to Handle All Types of Work.

Improved 'Buffalo' Bending Rolls are engineered for peak accuracy. Rugged construction insures long, trouble-free life. Optional attachments available.

See how 'Buffalo' Bending Rolls can save you production and maintenance time and money. For complete facts, contact your 'Buffalo' machine tool dealer or write the factory direct.

ESTABLISHED 1877 "Buffalo" MEMBER N.M.T.B.A.

MACHINE TOOL DIVISION

BUFFALO FORGE COMPANY

Buffalo, New York

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

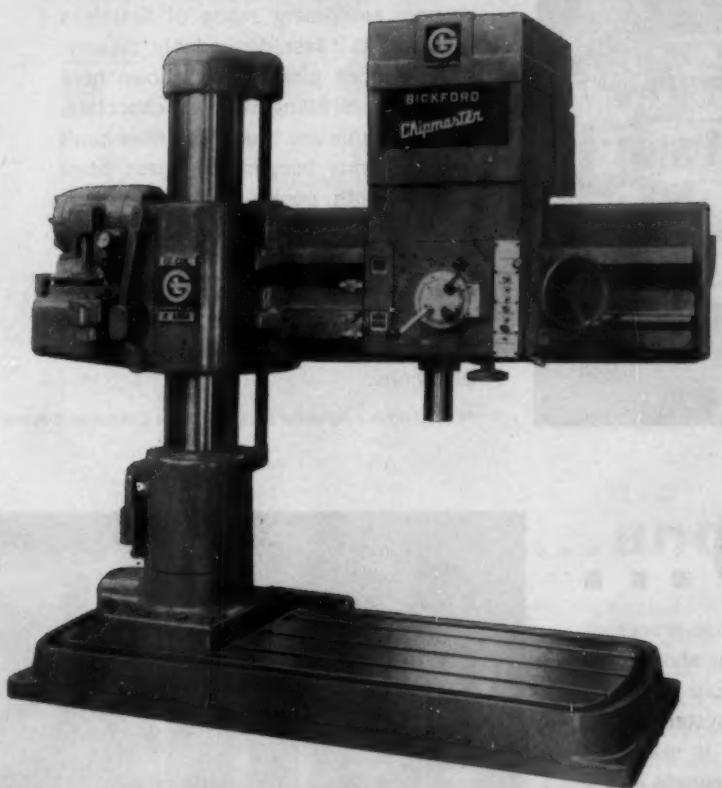
'Buffalo' Air Handling Equipment to move, heat, cool, dehumidify and clean air and other gases.

'Buffalo' Machine Tools to drill, punch, shear, bend, slit, notch and cope for production or plant maintenance.

'Buffalo' Centrifugal Pumps to handle most liquids and slurries under a variety of conditions.

Squier Machinery to process sugar cane, coffee and rice. Special processing machinery for chemicals.

ALL-NEW 11-INCH BICKFORD RADIAL DRILLING MACHINE



Fast, accurate, operator oriented... years ahead of anything in its class

. . . the only completely new 11″ heavy-duty radial drilling machine available *anywhere* — a machine designed to help the operator do a better job faster, with less effort — a rigid, rugged machine that will require less maintenance — a machine with design advances never before available on *any* radial.

Features include electric tapping reverse, hydraulic spindle counterbalancing, a magnetic clutch arrangement that never needs adjustment, four-bearing spindle with 14 inches of travel, a short, rugged column supported top and bottom by preloaded bearings, and a triple-box arm design that is the heaviest, most rigid available on an 11″ radial.

This machine comes to you at no premium in price. Call your G&L distributor for complete details.

GIDDINGS & LEWIS

GIDDINGS & LEWIS

GIDDINGS & LEWIS MACHINE TOOL COMPANY, Fond du Lac, Wis.

Jig borer and milling machine; horizontal boring, drilling, and milling machines; vertical turret lathes; vertical boring mills; positioning tables; die sinking machines; contour milling machines; radial and upright drilling machines; planers; planer mills; numerical and tracer control systems; Davis boring tools.

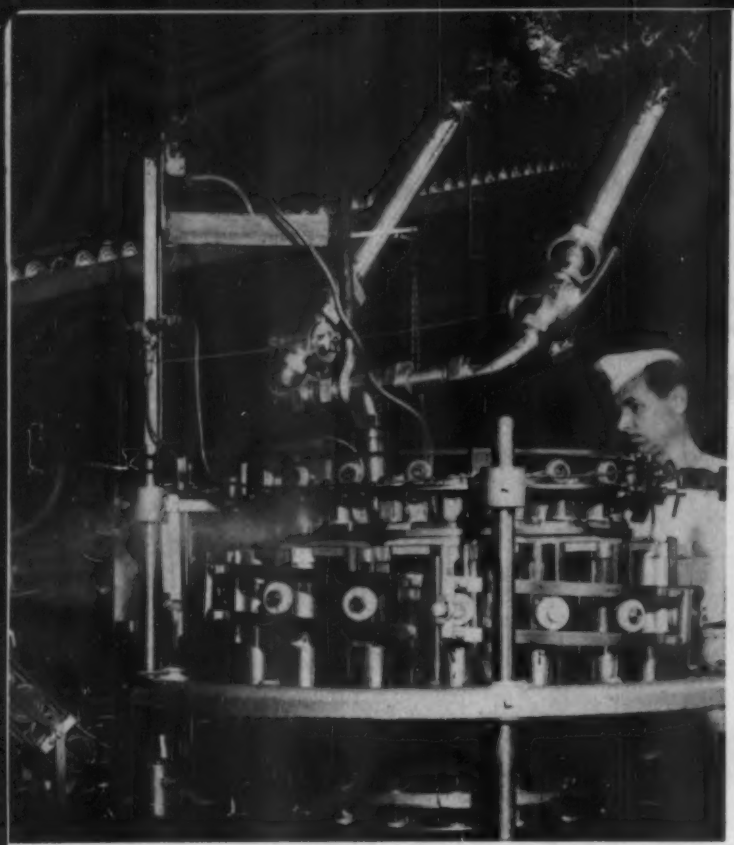
World's most complete line of heavy-duty radials and uprights—3 to 50 hp. Send for new 16-page folder.

28-INCH AUTOMATIC UPRIGHT . . . automatic single-cycle drilling and tapping, pushbutton control, wide range of speeds and feeds. Drive motors to 15 hp. Bulletin 3-CD.

PRODUCTION DRILLING MACHINE . . . for use with G&L 2-axis tape-controlled positioning tables. Tables from 38 x 50″ to 38 x 102″. 360″/min positioning with accuracy of ±.001″. Bulletin PT-2.

BICKFORD, 85 Years The Leader

For more than 85 years, Bickford has been the leading name in heavy-duty drilling machines. Today, at the modern, recently enlarged Giddings & Lewis plants in Wisconsin, skilled craftsmen produce the complete Bickford line . . . uprights to 39″ . . . radials to 34″ . . . gang drills . . . numerically controlled machines . . . portable and universal machines.



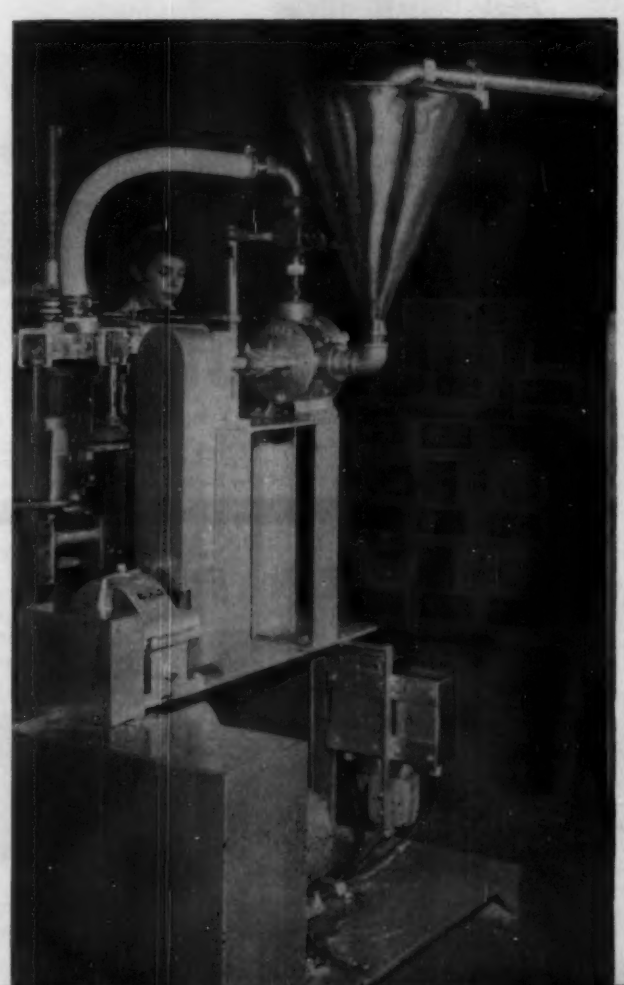
...LIQUID

If you make equipment that fills cans with chocolate or consomme, prune juice or pop, equipment made of Stainless Steel will do it fast, dependably, cleanly. The Votator* piston filler shown here happens to be filling cans with chocolate. Made of Stainless Steel, this filler can't harbor germs because Stainless Steel has a smooth, pocket-free surface. It is easily cleaned, too, so the strict standards of cleanliness that are mandatory in any food processing plant are easily maintained. Stainless Steel's resistance to corrosion makes it ideal for liquid applications.

VOTATOR is a registered trademark of the Chemetron Corporation.

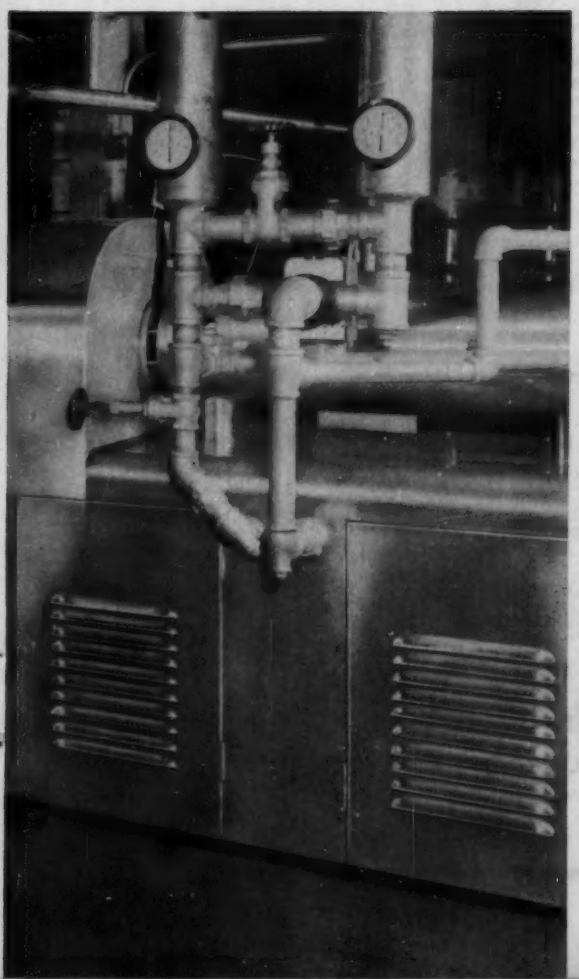
SOLID...

If you make equipment that processes solids like peanut butter or shortening, Stainless Steel can make your job easier and more profitable. This system makes peanut butter . . . and it makes it creamier. It takes whole peanuts in one end and grinds them, then Votator equipment heats them, cools them and turns out the finished product, ready for sandwich or cracker, at the other end. Here, Stainless Steel is used in the heads and shaft of the heat transfer area to assure maximum cleanliness. In a sealed unit like this one, corrosion could be a problem so Stainless Steel's inherent corrosion resistance is put to good advantage.



USS Stainless Steel . . . no other metal makes such a material difference in so many applications

This mark tells you a product is made of modern, dependable Steel.



...and in between

No material can match Stainless Steel's versatility. Stainless Steel offers designers and fabricators a unique combination of properties: superior strength, extraordinary corrosion resistance to an enormous variety of materials, outstanding properties at high temperatures, and attractive appearance. It is easily fabricated, and because Stainless Steel lasts longer, actually costs less in the long run.

For unmatched efficiency, durability, ultimate economy, specify Stainless Steels . . . no other metal makes such a material difference in so many applications.

If you have a selection or delivery problem, ask your USS representative or nearest Steel Service Center.

USS is a registered trademark

USS

United States Steel Corporation—Pittsburgh
American Steel & Wire—Cleveland
National Tube—Pittsburgh
Columbia-Geneva Steel—San Francisco
Tennessee Coal & Iron—Fairfield, Alabama
United States Steel Supply—Steel Service Centers
United States Steel Export Company

United States Steel

Watch United States Steel's special Christmas show, **The Coming of Christ,** in Color on NBC-TV, Wednesday, December 21, 8:30 P.M., E.S.T.

CALCULATED TO CUT COSTS

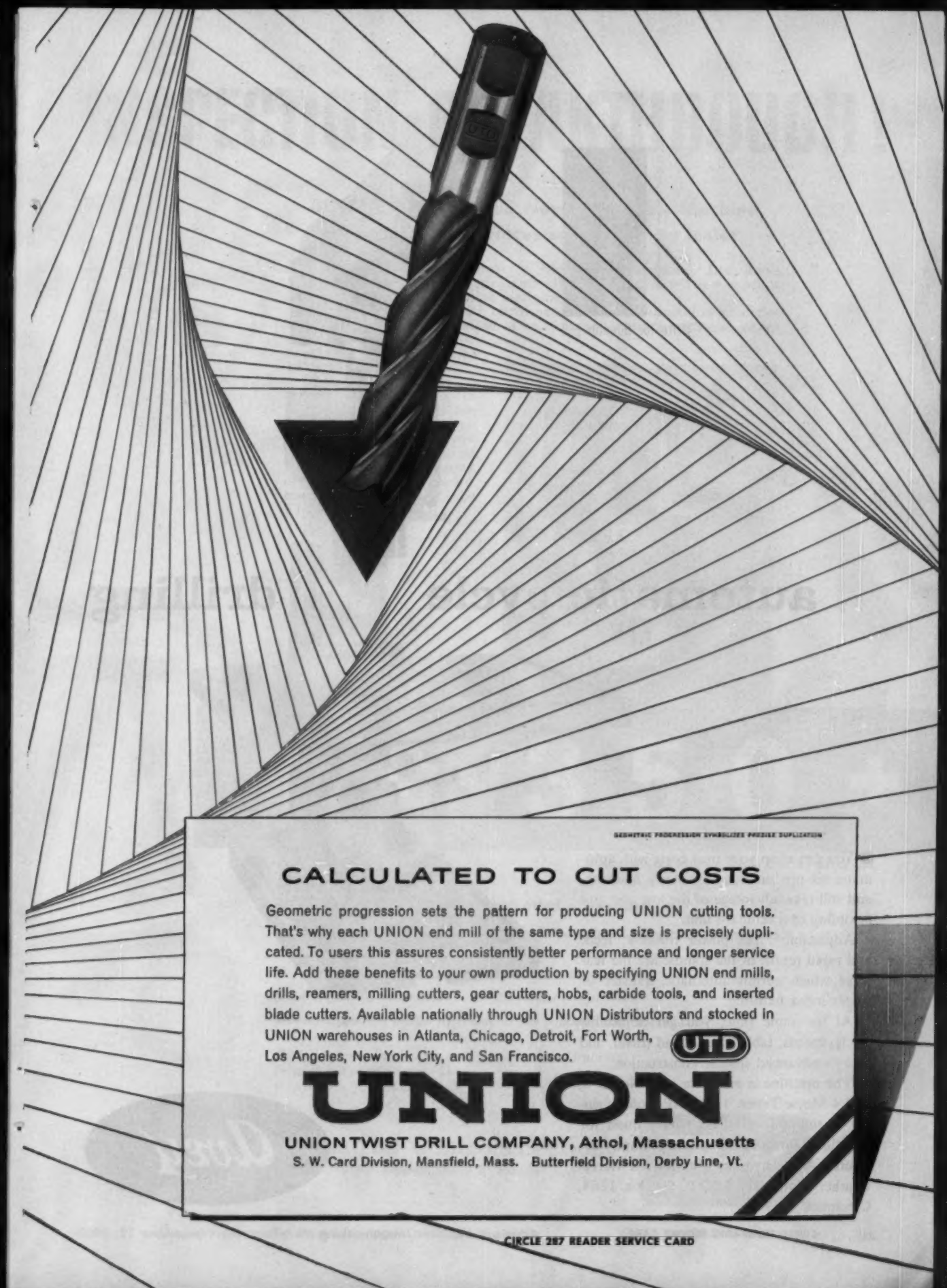
CARD gages, like forms in geometric progression are duplicated with consistent accuracy. Precise duplication like this can help you save production time and money. Get the gages you need from your CARD Distributor, who carries a full line of gages, taps, dies, and screw plates. And get expert advice on their selection and use from your CARD technical man. S. W. CARD DIVISION, Mansfield, Mass. Card Warehouses: Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York, San Francisco.

CARD

DIVISION OF UNION TWIST DRILL COMPANY

Serving you through the best distributors from coast to coast

CIRCLE 286 READER SERVICE CARD



GEOMETRIC PROGRESSION SYMBOLIZES PRECISE DUPLICATION

CALCULATED TO CUT COSTS

Geometric progression sets the pattern for producing UNION cutting tools. That's why each UNION end mill of the same type and size is precisely duplicated. To users this assures consistently better performance and longer service life. Add these benefits to your own production by specifying UNION end mills, drills, reamers, milling cutters, gear cutters, hobs, carbide tools, and inserted blade cutters. Available nationally through UNION Distributors and stocked in UNION warehouses in Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York City, and San Francisco.

UTD

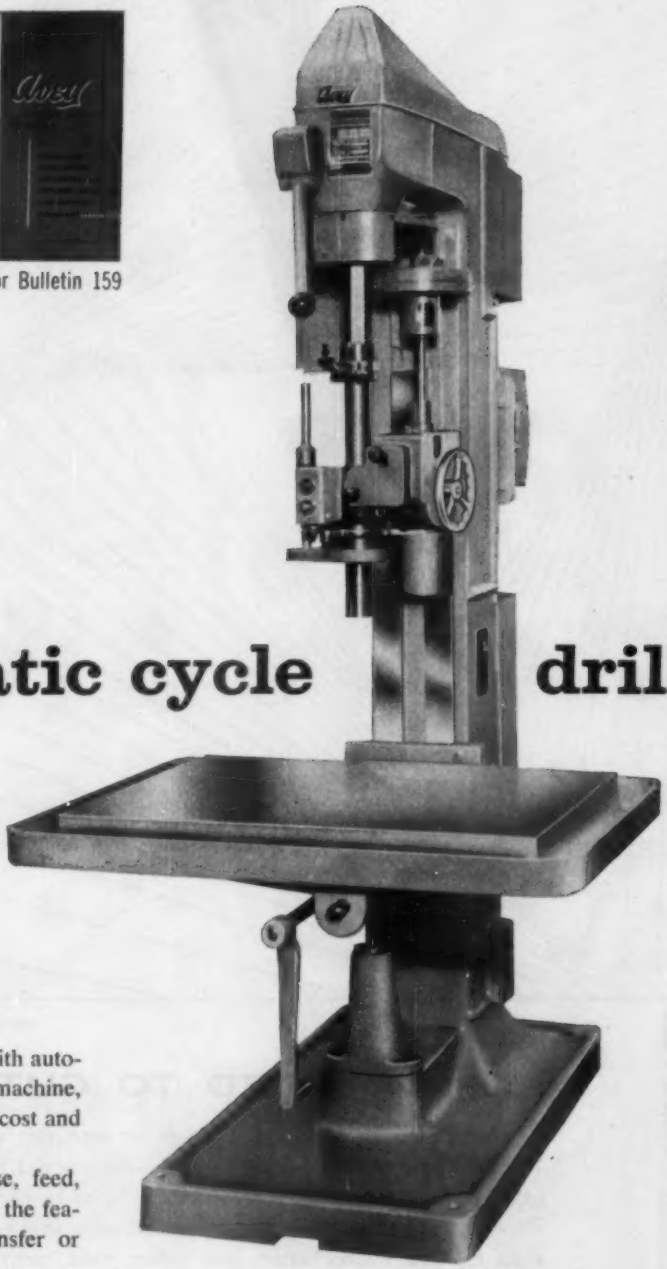
UNION

UNION TWIST DRILL COMPANY, Athol, Massachusetts

S. W. Card Division, Mansfield, Mass. Butterfield Division, Derby Line, Vt.

CIRCLE 287 READER SERVICE CARD

Write for Bulletin 159



automatic cycle drilling

■ You can chop your time costs with automatic set-ups on this new Avey machine, and still take advantage of the low cost and flexibility of a standard unit.

Adjustable rapid power traverse, feed, and rapid return of the spindle are the features which permit automatic transfer or rotary index fixturing.

At the same time, you get adjustable feeds, speeds, table travel, head travel, and Avey's advanced spindle construction.

The machine is available with No. 2, 3, and 4 Morse Taper; 1 to 3 HP motors; single or multiple spindles. Your request for additional information will be promptly answered. Avey Division, The Motch & Merryweather Machinery Co., P. O. Box 1264, Cincinnati 1, Ohio.

Avey

INSPECTION BREAKTHROUGH!

BENDIX ANNOUNCES New Coordinate Machine that inspects work pieces up to 10 times faster

The Bendix Industrial Controls Section and Ferranti, Ltd. have teamed up to bring the American metalworking industry a new concept in two-dimensional inspection equipment.

The revolutionary FI-22 coordinate measuring machine provides direct and continuous readout of hole center locations with one-set-up simplicity and with 0.001" accuracy over its entire 15" x 24" range.

Operator errors due to misuse or misreading of inspection instruments are essentially eliminated—one inspector can do the work of several with the help of the transistorized counting circuits and advanced mechanical design of the FI-22.

14·350+

Readout display numbers shown here are actual size.

The FI-22 features such other advantages as:

Large readout display—one set for each axis—little chance to misread these bright, ¾-inch digits.

Floating zero—set up at any point—measure in any direction.

Doubles as layout machine—for still further time savings.

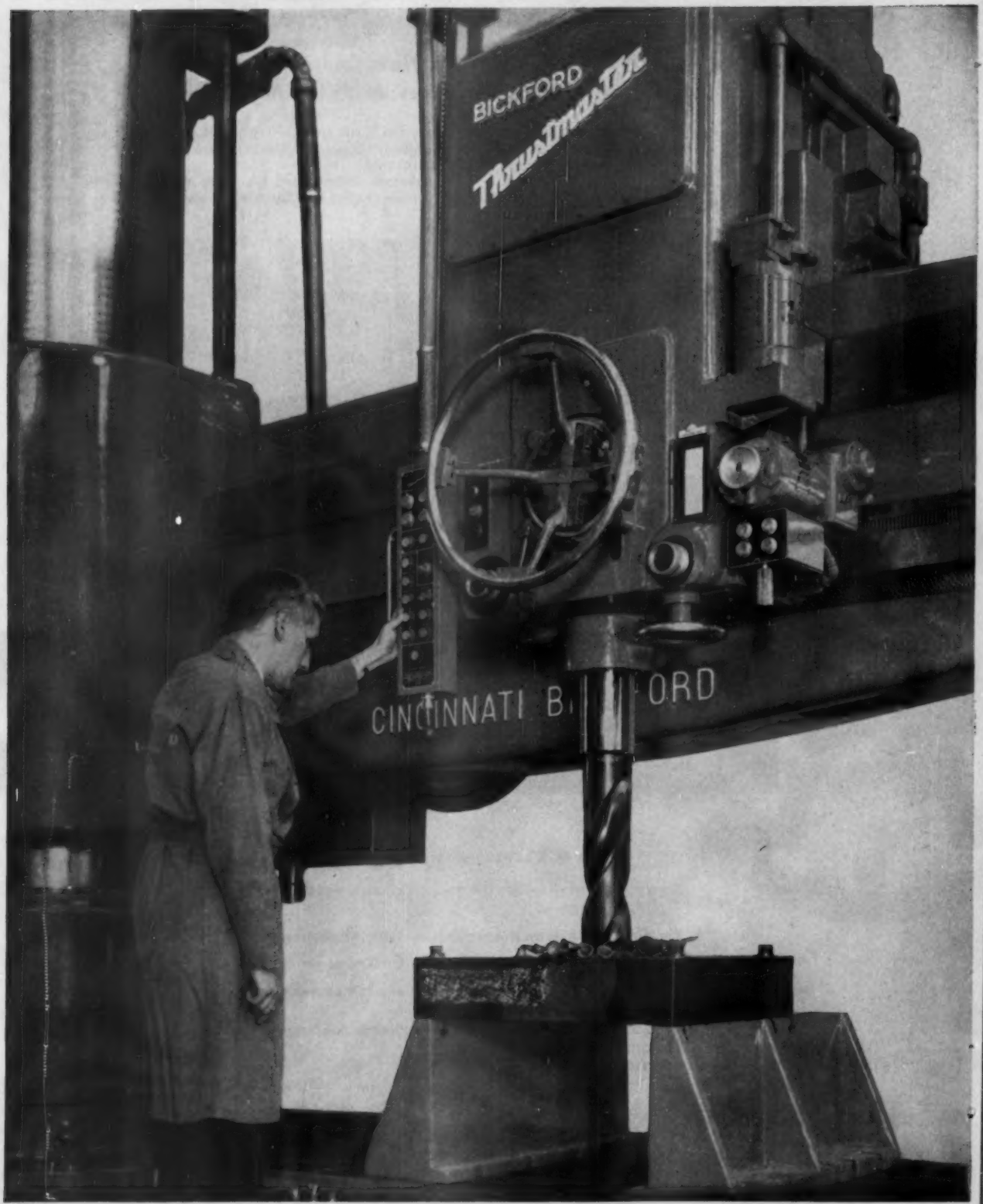
Interchangeable probe tips—inspect any hole or surface location.

Backed by complete Bendix service and customer training programs. For additional information, contact us today.

Industrial Controls Section
21820 Wyoming, Detroit 37, Michigan

THE Bendix CORPORATION

Morse Drills



Do It Again...

TAKE THE THRUST OF "THE WORLD'S MOST POWERFUL RADIAL DRILL"

To demonstrate their new 50-horsepower, pushbutton-operated Thrustmaster...the most powerful radial drill ever built... Cincinnati Bickford tooled up with the toughest twist drill on the market—Morse.

Why Morse? Because other drill manufacturers threw up their hands at producing a drill to match the Thrustmaster's power. But Morse took on the job, applied a regular taper shank drill right off the shelf that more than meets the requirements of this exceptionally powerful machine.

If you haven't already experienced the demonstrated superiority of the world's most complete line of quality cutting tools, call your Morse-Franchised Distributor today. He'll gladly show you the practical economies of buying the best... Morse Cutting Tools.

Look at these chips made during demonstration of the Thrustmaster.
Feed: .087" per revolution at 105 RPM
Drill: Regular Morse Taper Shank Drill (style 1302) driven in solid steel.

Morse CUTTING TOOLS

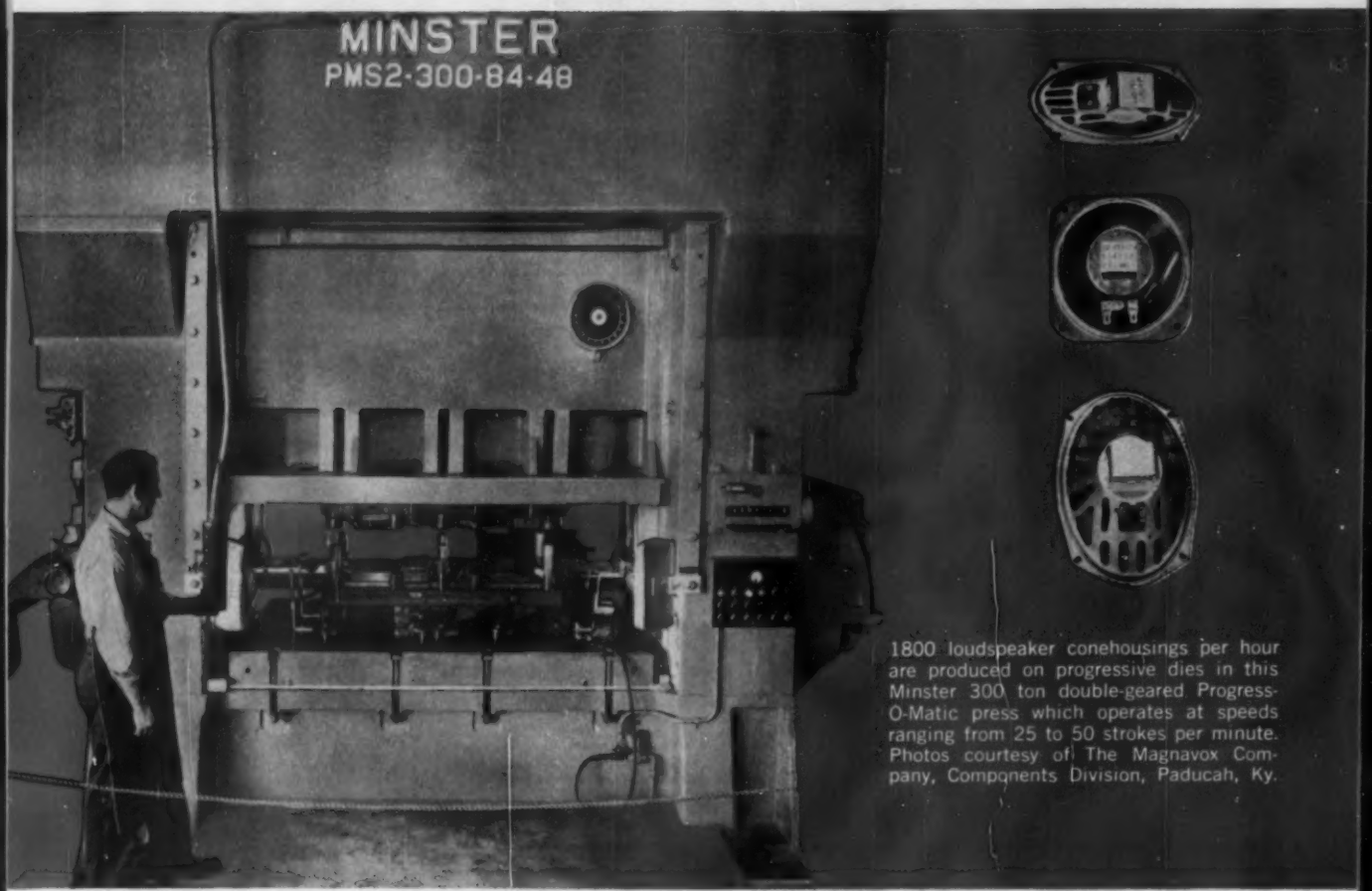
MORSE TWIST DRILL & MACHINE COMPANY
NEW BEDFORD, MASSACHUSETTS

WAREHOUSES IN NEW YORK, CHICAGO, DETROIT, DALLAS, SAN FRANCISCO

A Division of VAN NORMAN INDUSTRIES, INC. VN

MORSE means "THE MOST" in Cutting Tools

AUTOMATIC PRODUCTION reduces costs...savings pay for the press

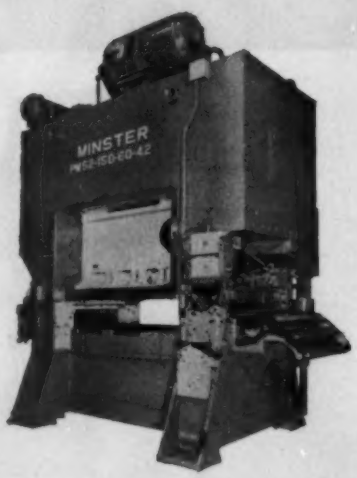


1800 loudspeaker conehousings per hour are produced on progressive dies in this Minster 300 ton double-geared Progress-O-Matic press which operates at speeds ranging from 25 to 50 strokes per minute. Photos courtesy of The Magnavox Company, Components Division, Paducah, Ky.

For Magnavox . . . this MINSTER Progress-O-Matic Press

saves 600% direct labor cost
saves 90% die maintenance cost
saves 75% die set-up time cost
saves 25% material cost
cut finished part cost by 50%

The interesting story on how Magnavox engineers achieved this outstanding cost reduction is contained in a reprint of an article which recently appeared in a leading magazine. May we send you a copy? Write to:

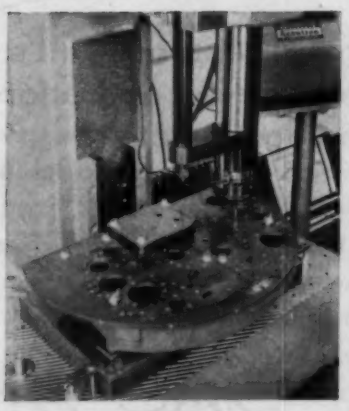


The Minster Machine Company • Minster, Ohio

MINSTER®

CIRCLE 292 READER SERVICE CARD

Difficult hole location problems solved for short runs



At the Westinghouse Ordnance Plant, Lansdowne, Maryland, a Sheffield Coordinate Measuring Machine determines the true location of 18 holes in a magnesium integrator or gear box. Fifteen holes are checked to ±.00017; two holes to ±.00023; and 1 to ±.000075 (75 millionths).

Inspection with a height gage and setting master previously took two days and did not determine out-of-round condition. The Sheffield gage reduced the time to six hours including set-up and cooling out—and checked for out of roundness as well. Overall accuracy of the gage has proved to be within .000075 on both horizontal axes and in the 10" vertical range. Repeatability is within .000010.

100% of the parts which passed inspection on this Coordinate Measuring Machine proved to be perfect in assembly, test, and field use. Short production runs of parts that vary widely in size and hole location, are easily handled.

Write for catalog number P-193 or check with your nearby Sheffield representative on your gaging requirements.

NEWS: **Before 11:00 a.m. on the first day of the NMTB Exposition in Chicago, September 6, 1960, a Fort Wayne, Indiana manufacturer bought a similar machine being demonstrated in the Sheffield booth. Additional orders continue to come in.**

The
SHEFFIELD
Corporation *Dayton 1, Ohio*

A subsidiary of The Bendix Corporation

Gages, Measuring Instruments, Automatic Gaging & Assembly Systems • Machine Tools • Contract Mfg.

Hydraulic presses should work smoothly, with no jerk or erratic action. But sludge and varnish in an Eastern plant's presses caused uneven operation, with increasing "rejects."

A Sinclair lubrication engineer recommended Sinclair's new DURO hydraulic oils with oxidation, rust and foam inhibitors. Result: outstanding performance, with "rejects" cut to minimum.

Let Sinclair tackle (and solve) your plant problems. Call your local representative or write...

Sinclair

SINCLAIR REFINING COMPANY

TECHNICAL SERVICE DIVISION • 600 FIFTH AVE., NEW YORK 20, N.Y.

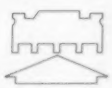
CIRCLE 294 READER SERVICE CARD

CIRCLE 295 READER SERVICE CARD ▶

When you think of PRECISION

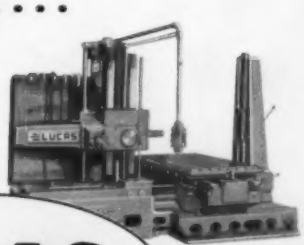
For life time precision Lucas provides

airlift to saddle

and table. 

These elements are supported on a thin film of lubricated compressed air during traverse. This separation of metal from metal virtually eliminates wear. During machining cycles the saddle and table are automatically clamped down tight to provide absolute rigidity for even the heaviest cuts. Unclamping is automatic, too. These are two aspects of Lucas design which contribute to the precision of these machines. Lucas Machine Division, The New Britain Machine Company, 12302 Kirby Avenue, Cleveland, Ohio. When you think of Precision . . .

think of . . .



LUCAS
PRECISION

When you think of RELIABILITY

Lucas automatic power positioning

automatically repeats

automatically repeats

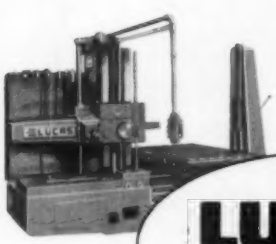
automatically repeats

to ±.0001 . . .

A simple, completely reliable system of dial indicators, end measures, and electrical controls automatically disengages rapid traverse, engages the fixed, constant-rate power feed and precision stops the unit at predetermined settings. Automatic power positioning assures the highest order of repetitive accuracy with an absolute minimum of operator attention.

A new catalog describes our complete line of horizontal boring, drilling and milling machines. Write Lucas Machine Division, The New Britain Machine Company, 12302 Kirby Avenue, Cleveland, Ohio. When you think of Reliability . . .

think of . . .



LUCAS
PRECISION

TOCCO Induction Hardening

Boosts Track Pin Production 10 Times

The Eimco Corporation of Salt Lake City are producers of heavy-duty earth moving and mining equipment. They recently replaced a low production induction hardening method with a modern, more efficient track pin hardening machine engineered and built by TOCCO for high production operation.

Production Jumped from 208 pins per shift to over 2000 using only one operator. Powered by a 200 KW 3 KC TOCCO motor generator, the new machine produces parts of higher uniform quality with correspondingly better results in service.

Additional Saving is obtained because TOCCO's new continuous roll feed machine does not need center holes in the pins, eliminating two centering operations on each pin.

It will pay you to have a TOCCO sales engineer review your heat treating applications. He can help you boost production and cut costs by the engineered application of induction heating.

TOCCO

THE OHIO CRANKSHAFT COMPANY

Mail Coupon Today—NEW FREE Bulletin

The Ohio Crankshaft Co. • Dept. B-12, Cleveland 5, Ohio

Please send copy of "Typical Results of TOCCO Induction Hardening and Heat Treating."

Name_____

Position_____

Company_____

Address_____

City_____ Zone____ State_____

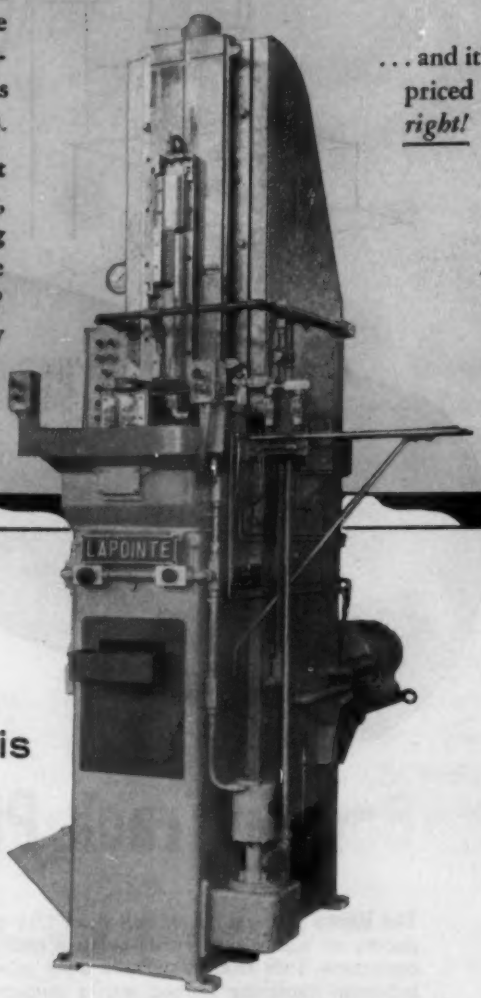
High production broaching of lightweight metals is the purpose of this extremely versatile machine, which is solving many problems where light tonnage and long strokes can be combined.

A noted American rifle manufacturer, for example, is Lapointe-Broaching the extractor pictured here, at the amazing production rate of 194 complete parts per hour — *with no further machining operations required on the broached surfaces.* Operation is fully automatic, including ejection of broached parts.

To lower your own production costs, while at the same time substantially improving your quality, you may find that this UVHS LAPOINTE Broaching Machine (or one of the others in our extensive series) can work miracles for you. Why not find out? An experienced Lapointe Field Engineer will gladly call on you, on request.

5-Ton, 54-inch Stroke

LAPOINTE Universal, Vertical, Hydraulic Single Ram BROACHING MACHINE can be adapted for **internal broaching** as well as **surface broaching.** Complete contour of the rifle extractor is broached in one pass, with stock removal approximately 50% of starting bar size. Steel bar stock .145" x .232" is automatically fed, clamped, broached and cut off to proper length of part. Production is 194 parts per hour, at 100% efficiency.



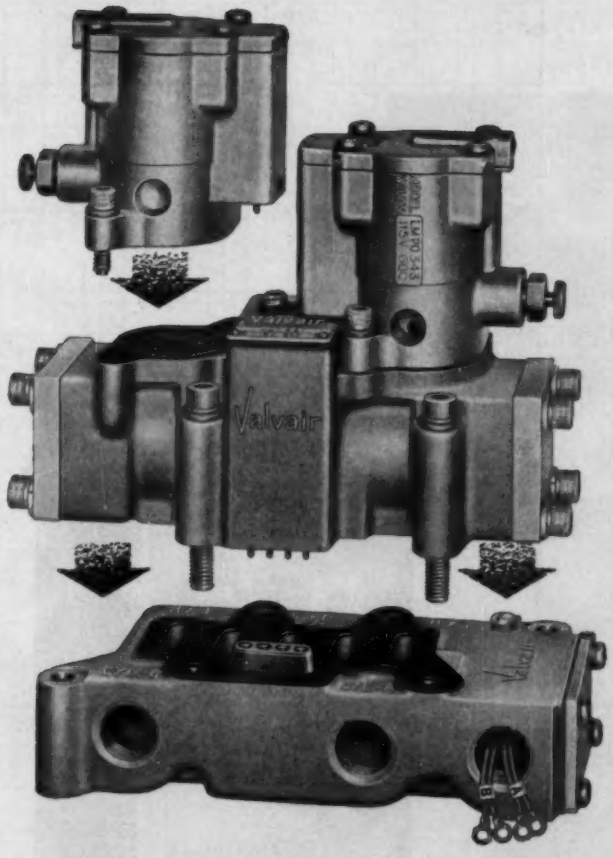
. . . and it's priced *right!*

Are you making
PRECISION GUN PARTS?
...MISSILE COMPONENTS?
If so, you should investigate this

uvhs LAPOINTE
fully automatic
BROACHING MACHINE

THE LAPOINTE MACHINE TOOL COMPANY
HUDSON, MASSACHUSETTS • U.S.A. *In England: Watford, Hertfordshire*
THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

LAPOINTE
known to be the best in
BROACHING



MODEL PD-441 shown. 4-way single or double pilot-operated types, for sub-base or manifold mounting. Aluminum and stainless steel components assure multi-million cycle dependability. Interchangeable pilots, with coils guaranteed against burn-out for life of valve, fit any plug-in Speed King. Coils for ac or dc, any voltage . . . 35 — 200 psi range . . . integral junction box . . . optional manual over-ride, common or separate exhaust ports, sub-base connected external pilot supply . . . ¾ in. exhaust ports, ½ or ¾ in. inlet and cylinder ports . . . valve meets JIC standards.

VALVAIR® ½" NPT PLUG-IN VALVES

Based on the service-proved design principle of the Speed King ⅓ in. plug-in Valvair's ½ - ¾ in. plug-in valve series provides plug-in convenience and versatility to a wider range of control valve applications.

Electrical and pneumatic circuits are completed automatically when valve and pilot are plugged in . . . bolted down. The result — cost-cutting reduction of original installation and maintenance time. All power connections are made permanently in sub-base or manifold . . . there's no need to disturb piping or wiring for quick in-service maintenance.

What's more, advanced design shortens stroke . . . speeds response. Separate coded (4-wire) circuits on double solenoid models meet JIC requirements. Flow area through valve and sub-base equals that of full ½ in. pipe.

Whether your control valve applications are on the drawing board or now in service, it'll pay you to investigate the advantages of Valvair plug-in design. A call to your near-by Valvair field office will bring prompt application engineering recommendations.

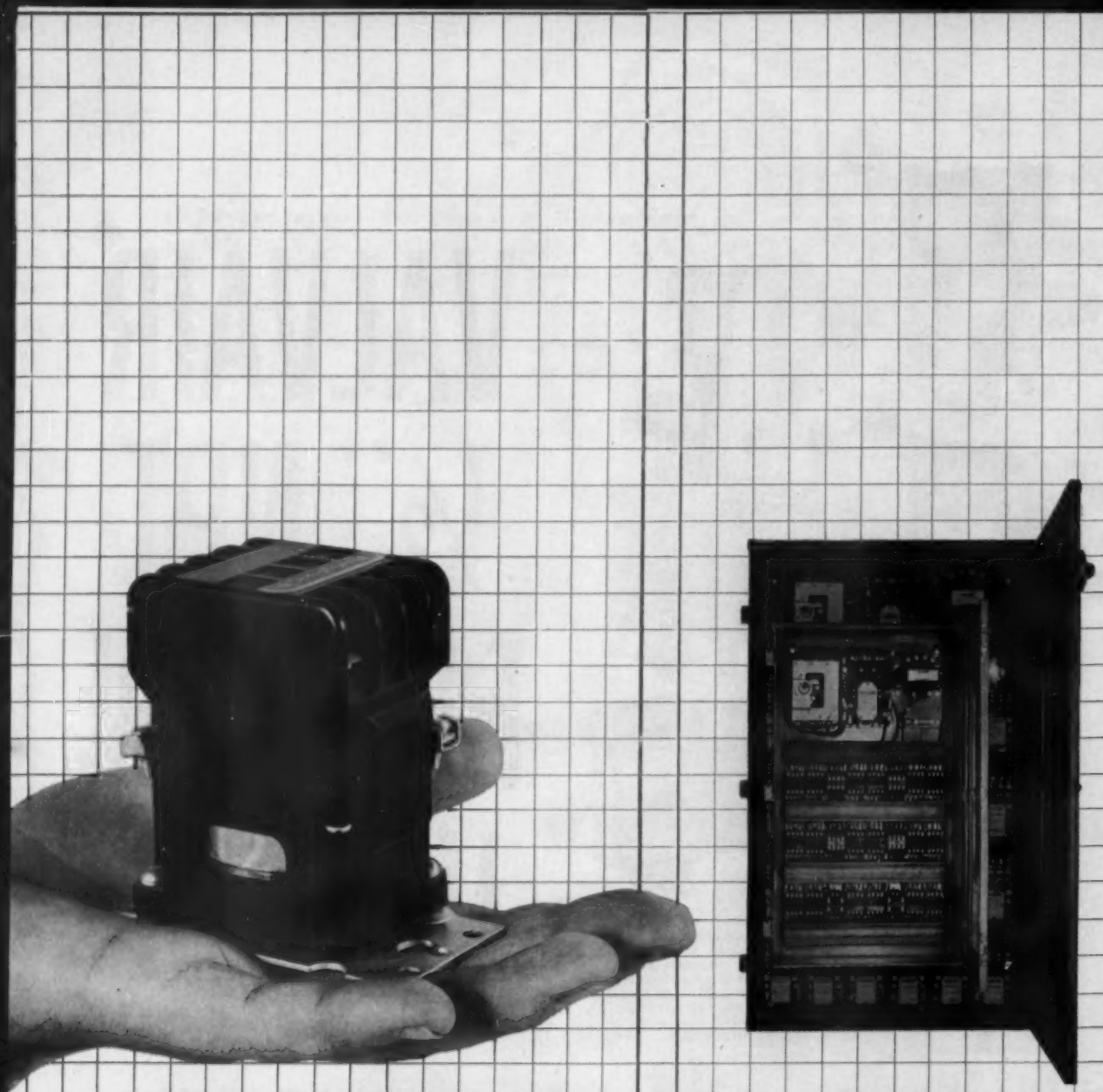
For more information, write for Bulletin SPL. Address Dept. AM-1260 Bellows-Valvair, Akron 9, Ohio

Bellows-Valvair

AKRON 9, OHIO

DIVISION OF INTERNATIONAL BASIC ECONOMY CORPORATION (IBEC)

8098-3

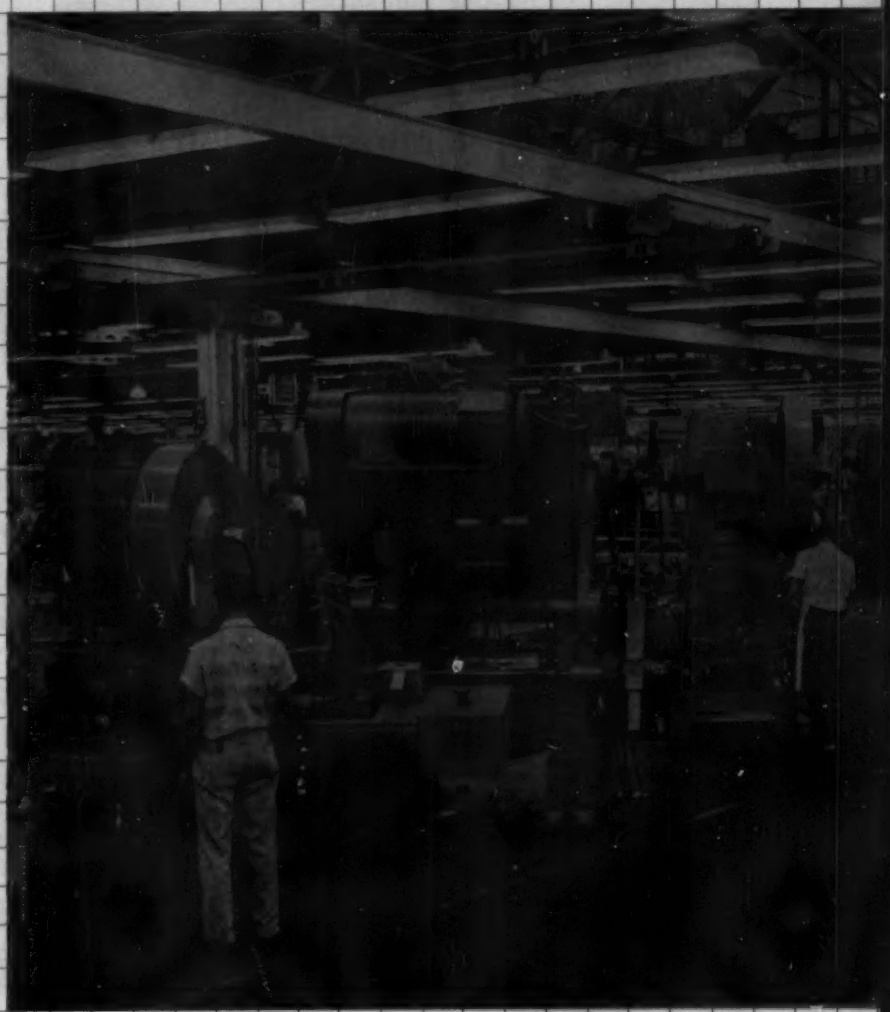


This new Westinghouse BF relay . . .

saves inches here . . .

This new Westinghouse BF relay is small and can be butted one against the other so that your control panels can be reduced in size as much as 50%. Result: valuable plant floor space available for additional machines. Because the relay is specifically designed for automated machine tools, you cut installed costs more than 20%. And since this relay is in stock, you get these savings NOW.

CIRCLE 300 READER SERVICE CARD



feet here . . .

Want more information on the 6-amp, 300-volt BF and its companion, the 10-amp, 600-volt AF? Contact your nearest Westinghouse representative . . . or write Westinghouse Electric Corporation, Standard Control Division, Beaver, Pa. J-30321-R

You can be sure...if it's **Westinghouse**

CIRCLE 301 READER SERVICE CARD

New Booklet on Tool Steel

EXPLAINS THE STEELECTOR SYSTEM THAT HELPS YOU...

• Pick the Proper Steel • Save Time • End Supply Worries
• Cut Your Inventory

This full color booklet gives you complete information on the new Allegheny Ludlum STEELECTOR Program. Each of the A-L STEELECTOR grades is listed in the booklet along with its description, applications, and AISI type number. Included are three handy STEELECTOR cards that will save you time in picking the proper steel for tool room, hot work, and high speed applications.

The booklet also describes the new Data Stock Lists that assure availability. There is a Data Stock List available for each of the Steelector grades. Each List shows the complete necessary range of available sizes and shapes—tells you the heat treating and forming characteristics.

You will like the no-nonsense approach of the STEELECTOR Program. Everyone concerned with tool steel selection needs a copy of this explanatory booklet. For your free copy ask your A-L representative or write: *Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pennsylvania. Address Dept. AM-12-1.*

STEELECTOR PROGRAM

ALLEGHENY LUDLUM
Tool Steel warehouse stocks throughout the country

2085

ANOTHER NORTON PRODUCT

The Reason for Resin

(resin-bonded belts)

Simply this: Behr-Manning *resin*-bonded* belts (and discs) out-last and out-produce glue-bonded ones for roughing and finishing. Why? Because loading and breakdown are minimized. You get more cutting for your belt dollar.
Prove it. Ask for an in-plant demonstration. Write Dept. AM-12, BEHR-MANNING CO., Troy, N. Y., a division of Norton Company.

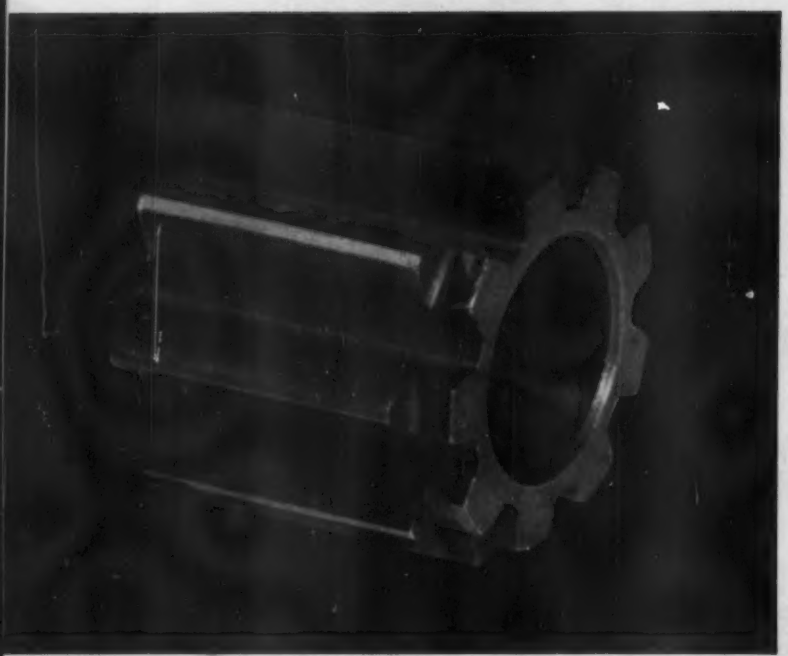
*RESINALL® . . . *an all-resin-bonded aggressive belt of strong X-weight cloth, for maximum heat resistance in most all rough and intermediate grinding operations.*

*RESINIZED® . . . *a resin-over-glue belt of good heat resistance, in strong X-weight for flat polishing, and in flexible J-weight for contour polishing.*

BEAR Abrasives

Requirement:

HIGH-MACHINABILITY

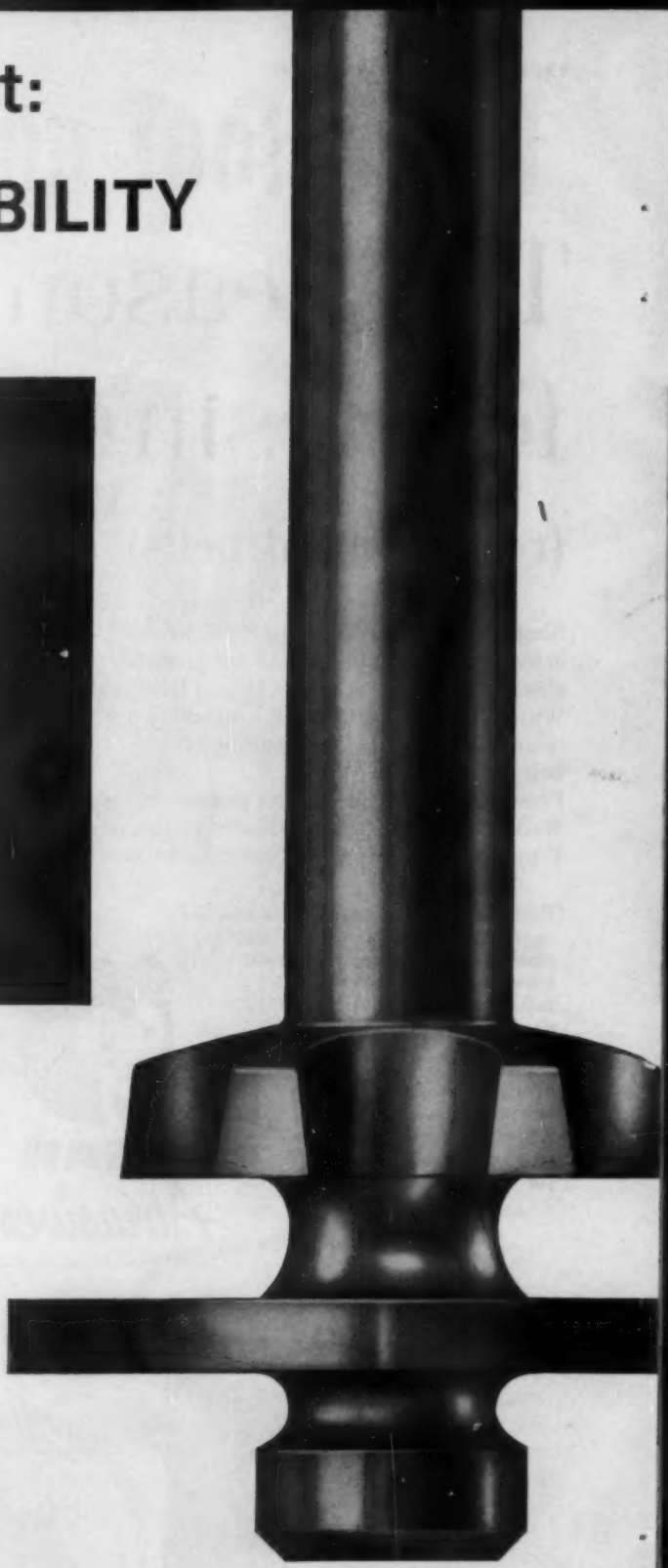


Choice: REPUBLIC 8617 ALLOY STEEL

In machining automobile starter drive pinions, Eclipse Machine Division, Bendix Aviation Corporation, Elmira, New York, uses Republic Cold Drawn Alloy Steel. Alloy bars are blanked, hobbed, chamfered, and drilled. Teeth are cut on a gear hobber, then pointed for easy meshing with the flywheel. In addition to greater strength and dependability, this cold drawn alloy steel gives Eclipse better machinability at reasonable cost. Send coupon for details.

Choice: REPUBLIC ENDURO® STAINLESS STEEL

In machining one-piece Hyseal Valve Stems for new American-Standard single-lever mixing faucets, National Acme Company, Cleveland, Ohio, uses Republic Type 303 Stainless Steel. Completed in a single setup, 10 operations including a multiple end drilling of six holes on a 15° angle are performed in 12 seconds. For information on the more than 40 standard types of stainless steel available from Republic, mail the coupon.

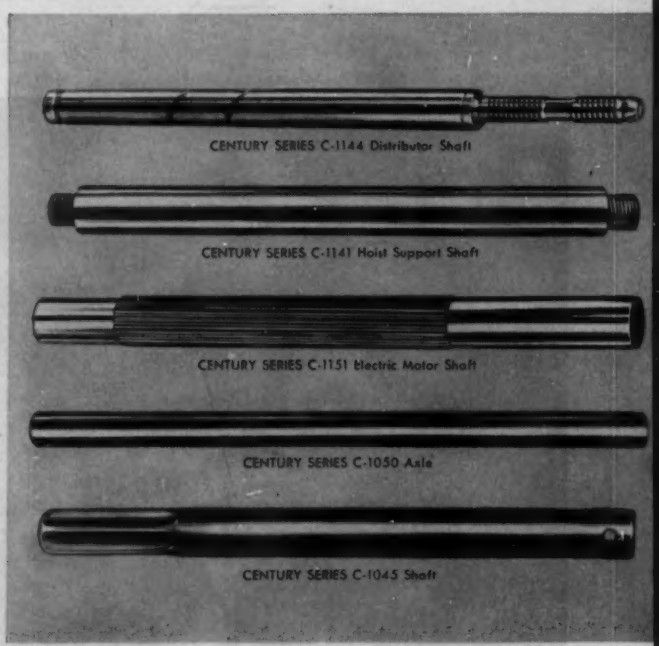


Choice: REPUBLIC LEADED ALLOY

In machining heavy-duty herring bone gears, Philadelphia Gear Corporation, King of Prussia (suburban Philadelphia), Pennsylvania, uses Republic Type 4140 Hot Rolled Leaded Alloy Steel. Bars are rough turned on a lathe and heat treated to a 300 Brinell prior to gear cutting. Leaded alloy and carbon steels are available in almost every standard analysis and many specials. The addition of lead increases machinability as much as 25%. Heat treating assures adequate strength and toughness. Return the coupon for information.

Choice: REPUBLIC'S CENTURY SERIES

For high strength with varying degrees of machinability, Republic offers five grades of cold finished, stress relieved, carbon steel bars with a minimum yield strength of 100,000 psi. Selection of the proper grade—C-1144, C-1141, C-1151, C-1150, or C-1045—can result in substantial savings in machining and/or material costs. The CENTURY SERIES gives you dimensional stability with high physical properties in a range of chemistries. Mail the coupon for a free copy of Republic's CENTURY SERIES booklet.


CENTURY SERIES C-1144 Distributor Shaft
CENTURY SERIES C-1141 Hoist Support Shaft
CENTURY SERIES C-1151 Electric Motor Shaft
CENTURY SERIES C-1050 Axle
CENTURY SERIES C-1045 Shaft

Choice: REPUBLIC METALLURGICAL AND MACHINING SERVICE

Mill, field, and laboratory metallurgists and machining experts will help you select, apply, and process the steel best suited to your overall requirements. Write today or mail the coupon for details on this confidential, obligation-free service.

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- ☐ Stainless Steel
- ☐ Alloy Steel
- ☐ Leaded Steel
- ☐ Republic's CENTURY SERIES
- ☐ METALLURGICAL AND MACHINING SERVICE

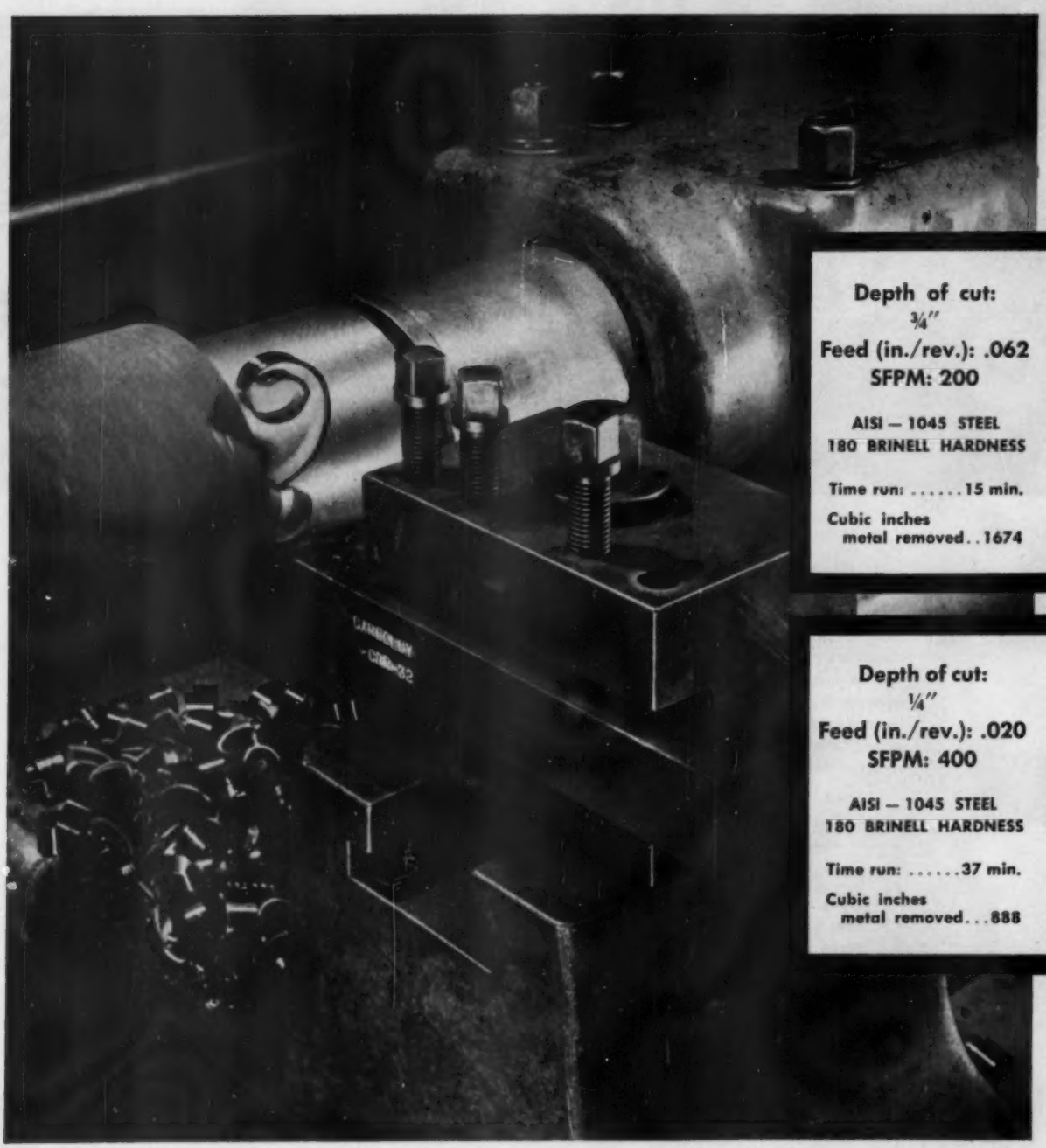
Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

Why ?



Depth of cut:
¾"
Feed (in./rev.): .062
SFPM: 200

AISI — 1045 STEEL
180 BRINELL HARDNESS

Time run: .....15 min.

Cubic inches
metal removed..1674

Depth of cut:
¼"
Feed (in./rev.): .020
SFPM: 400

AISI — 1045 STEEL
180 BRINELL HARDNESS

Time run: .....37 min.

Cubic inches
metal removed...888

Why is one Carboloy carbide grade best for light-duty steel-cutting applications; another more suitable for heavy-duty jobs? And which should you use?

Carbide selection can be scientific (and *should* be!) if you are going to get optimum results from your steel-cutting operation.

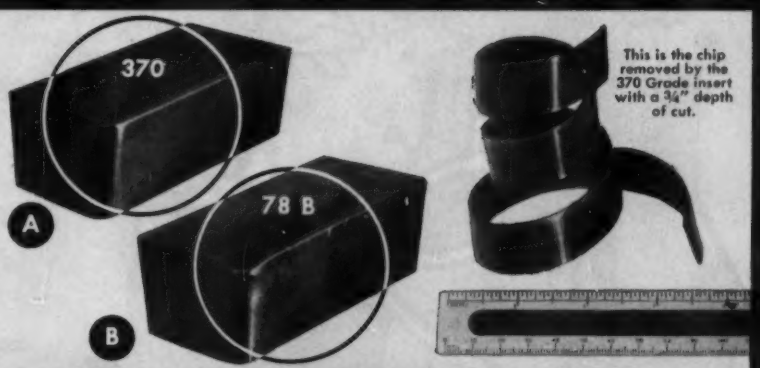
Take the job-graded Carboloy Grades 78B* and 370, for example. The 78B Grade is designed to offer real economy in normal steel-cutting applications—where machine power is limited. The 370 Grade, on the other hand, was developed specifically for heavy-duty steel-cutting jobs. Look over the following examples; then contact your Carboloy representative, or Authorized Carboloy Distributor, for information on Carboloy *job-graded* carbides for your specific operation. Take advantage of *better profits through better tooling.* Call today, or write: *Metallurgical Products Department of General Electric Company, 11149 E. 8 Mile Street, Detroit 32, Michigan.*

*Carbides in 78 Series are all pre-honed. Carbides in the 300 series are available pre-honed, precision-ground, or utility-ground.

HEAVY-DUTY MACHINING

Photograph A shows the Carboloy 370 Grade insert after the run. Wear land was only .012", and there is no deformation (upsetting) of the cutting edge. Photo B shows the 78B Grade insert after the same run. Note the deformation of the cutting edge . . . Grade 78B was not designed for such severe cutting pressures.

CONCLUSION: *In this heavy-duty application, Carboloy 370 Grade is recommended.*



LIGHT-DUTY MACHINING

In this light-roughing application there is little visible difference between the Carboloy 78B Grade insert (Photo A) and the 370 Grade insert (Photo B). Because 78B Grade is job-graded for light- and medium-roughing applications, it will wear as long as 370 Grade. Grade 78B insert is lower in initial cost, so in this case it makes good sense to use Grade 78B. In this example, the wear land on 78B insert was only .010".

CONCLUSION: *In this normal steel-cutting application, Carboloy 78B Grade is recommended.*

CARBOLOY CEMENTED CARBIDES

METALLURGICAL PRODUCTS DEPARTMENT

GENERAL ELECTRIC

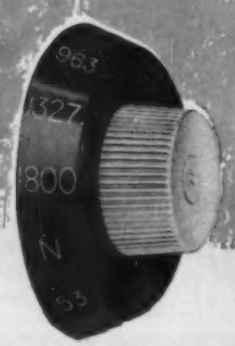
CARBOLOY® CEMENTED CARBIDES • MAN-MADE DIAMONDS • MAGNETIC MATERIALS • THERMISTORS • THYRITE® • VACUUM-MELTED ALLOYS

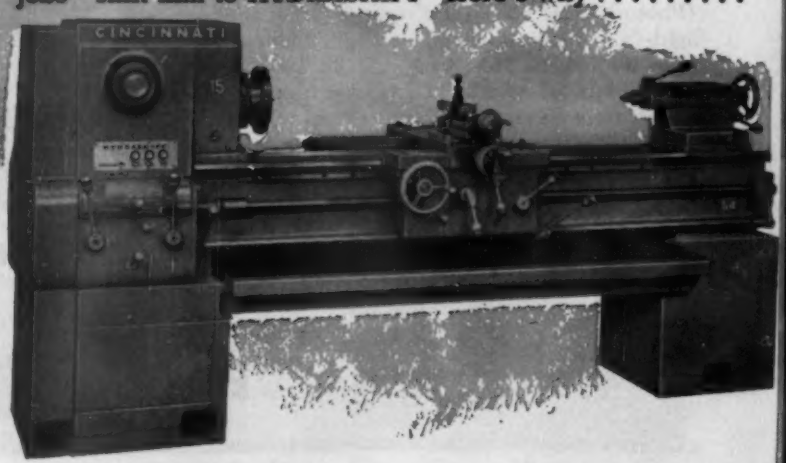
STOP these men from stealing your profits.....

You know about this fellow . . . he's stealing "cash", and you do try to stop him.

But **YOU** cause this theft . . .
you force this man to steal your profits . . .
make him add to labor and burden costs on most lathe jobs, no matter how hard he works.

The solution is easy:
make your operator a *cost-reducer* on **ALL** of his lathe jobs—shift him to HYDRASHIFT* Here's why .....





*HYDRASHIFT is Cincinnati's new lathe line with *the new way to change spindle speeds . . . hydraulically!*

Compare the machining of this typical lathe job,

two steps

and two necks

on the new HYDRASHIFT . . . on a conventional lathe

As second step is being cut, operator turns the dial to speed required for the necking cut.

Operator waits for machine to complete the step cuts.

Step cuts completed, operator changes to necking tool (he had it lying on the convenient Tray-Top) and positions tool for cut.

Step cuts completed, operator changes to necking tool and positions tool for cut.

Operator engages spindle lever and cuts the neck—*without leaving apron.*

Operator goes to headstock, shifts various levers to change to spindle speed for necking cut.

Necking cuts completed, operator changes tools for next workpiece.

Operator returns to apron, engages spindle lever, and cuts the neck.

Don't force your lathe operators to steal profits from your pockets—take a look at the new Cincinnati HYDRASHIFT Lathes at your nearby Cincinnati Lathe and Tool Dealer's showroom. If you can't reach him immediately, wire collect!

CINCINNATI LATHE AND TOOL CO. CINCINNATI 9, OHIO

HYDRASHIFT Lathes/CINCINNATI Drilling Machines/SPIROPOINT Drill Sharpeners

JONES & LAMSON "AUTOMATION"

the man who needs a new machine tool is already paying for it

Completely automatic turret lathe gives peak production efficiency

J & L's new, completely automatic turret lathe sets a new high standard of efficiency for both bar and chuck work. Now, for the first time, you have the versatility of turret lathe tooling combined with completely automatic operation. All machine functions and sequences are pre-selected and programmed by the operator or set-up man, from a staging panel during initial set-up.

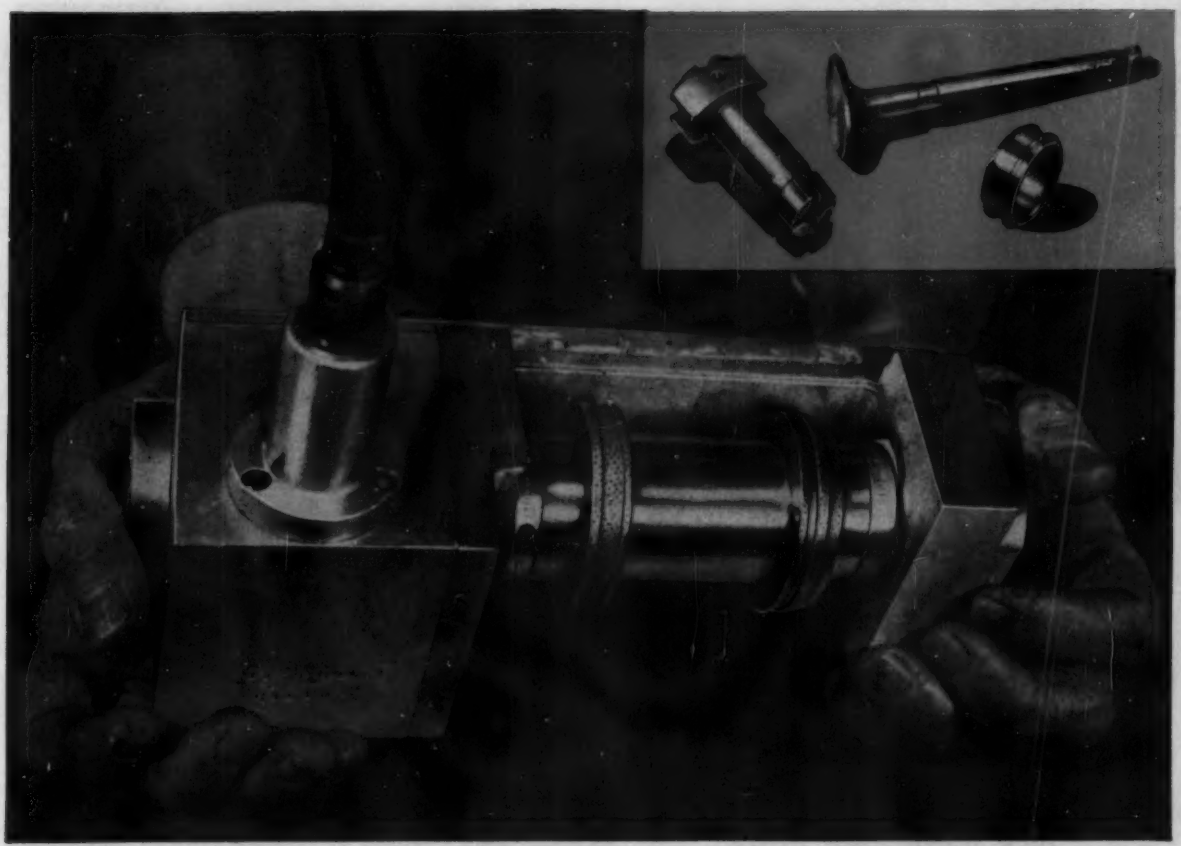
The automatic machine characteristics of this new lathe include fast motion, variable speed selection, spindle speed selection, turret indexing, coolant on and off, bar feed, and cycle stop.

A noteworthy feature is the automatic operation of a 12-speed hydraulic clutch headstock combined with a 24″ saddle motion which is actuated by a closed-loop, two-stage hydraulic servo system.

The cross slide has a 14½″ stroke and drive similar to that of the saddle, and has several automatic cycles, as programmed from the staging panel. Three speed ranges are available: 20 to 1000; 30 to 1500; and 40 to 2000 RPM. Power is from a single speed motor (up to 40 HP). Feed range is from .750″ per minute to 30″ per minute for the saddle, and from .375″ per minute to 15″ per minute for the cross slide.

Send now for our folder on this remarkable new machine. Jones & Lamson Machine Company, 502 Clinton Street, Springfield, Vt.

Turret Lathes • Automatic Lathes • Tape Controlled Machines • Thread & Form Grinders • Optical Comparators • Thread Tools



THIS TRU-GRIT® ROTARY DIAMOND DRESSING WHEEL forms grinding wheels with speed, accuracy and economy unapproached by any other method

It form dresses ANY grinding wheel—vitrified, resinoid, silicate, rubber or shellac bond. It has none of the limitations of crusher roll or single point diamond tool forming; it develops complex configurations and sharp, deep, square grooves with absolute accuracy, assuring exact reproduction in the work piece. It may do this in a single, quick pass between ejection and loading, without interrupting the production cycle. Downtime for tool changing on every shift is out; the Tru-Grit Rotary Diamond Dressing Wheel's finishing and dressing life goes far beyond anything known before. Savings in downtime, the increased number of pieces produced, the lower cost per piece over the life of the Tru-Grit Rotary Wheel are things to make cost engineers take a second look. But, perhaps the most dramatic difference of all is in the meticulous accuracy, fine finish and routine uniformity of the processed pieces. This is what quality control engineers have dreamed about and it makes quality control reports something of a formality. If you'd like facts and figures on actual applications of the Tru-Grit Rotary Diamond Dressing Wheel, write us.

WT

MEMBER

WHEEL TRUEING TOOL COMPANY

1910 **SEMI-CENTENNIAL** *1960*

Main plant and office: 141-3200 W. DAVISON, DETROIT 38, MICHIGAN
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with this NEW Cadillac Bore Set PLA-CHEK

You can set:

DIAL BORE GAGES
INSIDE MICROMETERS
TELESCOPING GAGES
INTERNAL CYLINDER GAGES

. . . much faster than you can read this page!

It's true! Time-saving is one of the big features of this new Cadillac Bore Set PLA-CHEK. Guaranteed accuracy is another! Designed especially to save time, money and to provide extreme accuracy in the setting and checking of Dial Bore Gages, Inside Micrometers, Telescoping Gages and Internal Cylinder Gages, this new PLA-CHEK is guaranteed to .000050". No gage blocks need be used and, in most cases, ring gage setting masters are not necessary. This new PLA-CHEK is the result of over 16 years' experience in the building of high-precision PLA-CHEK Gages. It is designed for easy portability on the job so that it may be used either on the surface plate or at the machine. Write, wire or telephone TODAY for prices and additional information.

Use it as a regular PLA-CHEK, too!

Cadillac GAGE COMPANY

P. O. BOX 3806 • DETROIT 5, MICHIGAN

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MASTERS and PADS

FOR BETTER PERFORMANCE — BETTER PRODUCTION

AND

PROFITS

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STYLE "S"
MASTER COLLETS and PADS

The Only Master Collet with
No Work Pressure On The Screw

Available For: Cleveland-Cone
Greenlee—Gridley and Acme-Gridley
National Acme—New Britain
Warner & Swasey

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STYLE "B"
MASTER FEED FINGERS and PADS

Pads Cannot Work Loose
No Screws — No Pins

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HARDINGE BROTHERS, INC., ELMIRA, N. Y.

▲ CIRCLE 313 READER SERVICE CARD

CIRCLE 314 READER SERVICE CARD ►

NATCO
HOLEWAY
NATCO
HOLEWAY
NATCO

Machining sequence is straight line, controlled from a single station, with pallet return conveyor.

Compact Machining for Compact Cars

Quality, quantity, and convenience in minimum space mark this Natco Holeway, built for machining steering knuckles for one of tomorrow's compact cars. It's a pallet-type machine, and once right and left hand knuckles are clamped in the pallet, there's no rehandling through 48 separate machining operations (plus many probing, cleaning, and orienting operations).

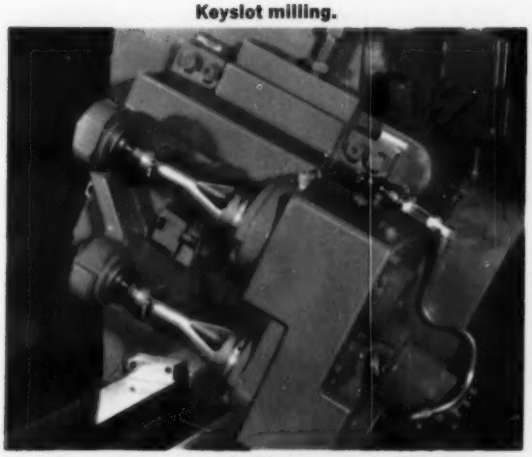
Building block construction accommodates 18 separate stations in one tight package, and will save tremendously in lead time and rebuilding costs when it comes time for model changeover. The machining operations include drilling, tapping, deburring, taper reaming, face milling, chamfering, straight reaming, threading, and keyway milling. Production rate? 100 parts an hour.

Whether you manufacture parts for compact cars or trucks, Natco has a way to machine them better. Call your Natco representative for facts.

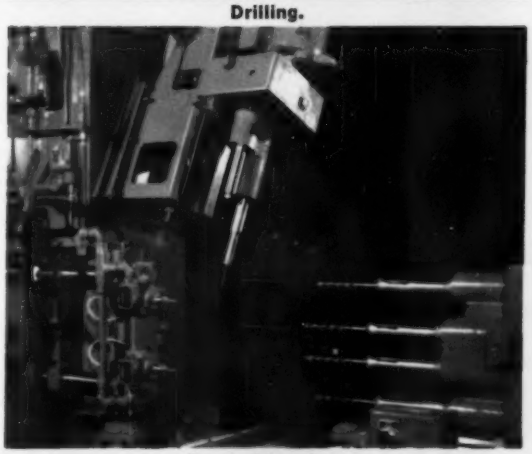
NATCO

The National Automatic Tool Company, Inc., Richmond, Indiana

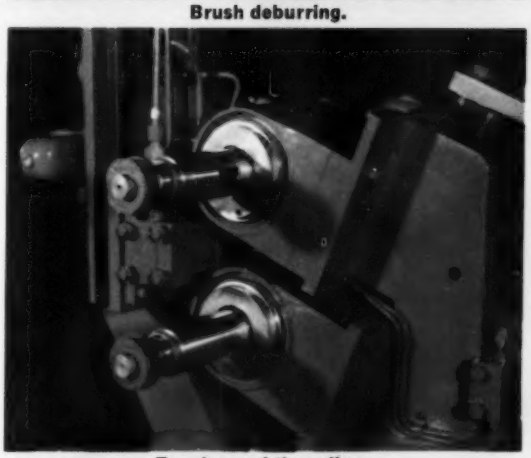
Keyslot milling.



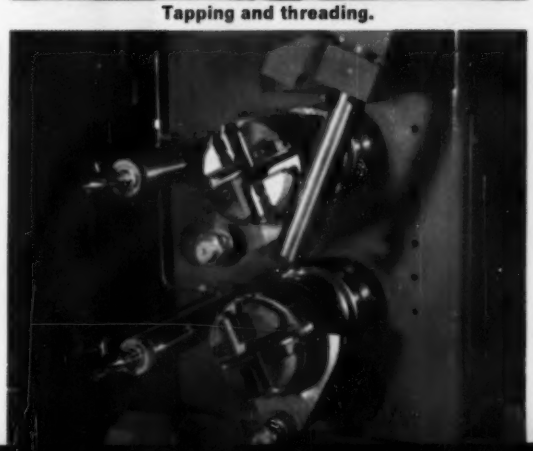
Drilling.



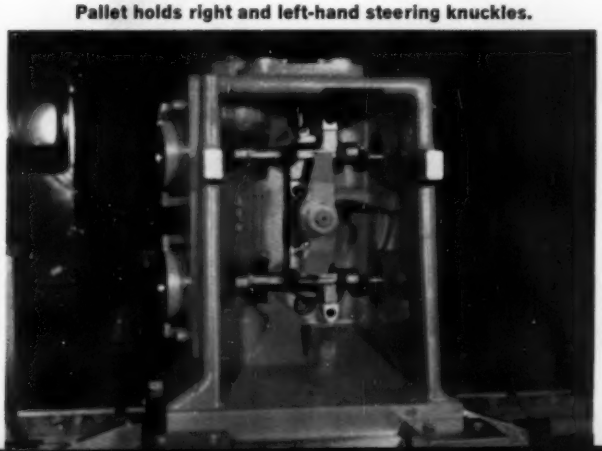
Brush deburring.



Tapping and threading.



Pallet holds right and left-hand steering knuckles.



He's Watching a Band Sawing Miracle

This band saw operator at the Bell & Gossett Company plant in Morton Grove, Illinois, is watching "Controlled Accuracy". . . accuracy, being held to within a few thousandths of being perfectly straight, and he can actually *see* the band blade being guided in the saw cut to produce this accuracy! No further machining is required before the pipe is welded into an assembly for a Bell & Gossett Heat Exchanger Unit.

Band sawing accuracy like this is nothing short of miraculous—especially when it can be done on a high production basis, as Bell & Gossett is doing. And when the same tolerances can be held on cut-off pieces from 2″ to 18″ in diameter, this MARVEL #81 Band Saw Machine can be truly called a precision machine tool.

The secret of this amazing sawing accuracy is in the MARVEL "SURE-LINE" Automatic Accuracy Control—a simple and extremely effective electro-mechanical servo-mechanism that continuously senses and automatically corrects any tendency of a band blade to drift to either side of a desired line of cut. The "SURE-LINE" unit literally "steers" the blade to make a straight cut. This permits the use of heavier feed pressures and, when desirable, higher blade speeds, to do the work faster, without sacrifice of accuracy. Incorporated in the new MARVEL #81 Series High Speed Heavy Duty Hydraulic Band Saws, the "SURE-LINE" permits full utilization of all the advantages of high speed steel band saw blades—while extending their usable blade life as much as 50%.

Before you buy any band saw machine, get complete details on MARVEL #81 Series Single Cut, or Automatic Shuttle Type Bar Feed Production Band Saws—the machines DESIGNED AND BUILT TO REDUCE SAWING COSTS. *Write for catalog today.*

ARMSTRONG-BLUM MANUFACTURING CO.
5700 West Bloomingdale Avenue • Chicago 39, Illinois

MARVEL *Metal Cutting* SAWS
Better Machines–Better Blades

CIRCLE 315 READER SERVICE CARD

▲ CIRCLE 316 READER SERVICE CARD

Have you sent for this FREE book and Calculator?

Here is a new book, written in simple language, that describes the "Do's" and "Don'ts" in welding USS "T-1" Steel. Included in the booklet is a handy heat input circular computer that helps you choose the proper welding machine settings. Both will help every welder to do a more reliable job and make his work easier.

USS "T-1" Steel has become famous for three properties not usually found in a single steel: very high yield strength, excellent toughness and good weldability. The booklet will tell you how to weld "T-1" Steel successfully without affecting either its strength or toughness.

The information is based on the experience of our many field service men whose jobs are to help customers fabricate "T-1" Steel. It contains the results of nine years of work with hundreds of users, and shows how to apply common practices in the welding of "T-1" Steel.

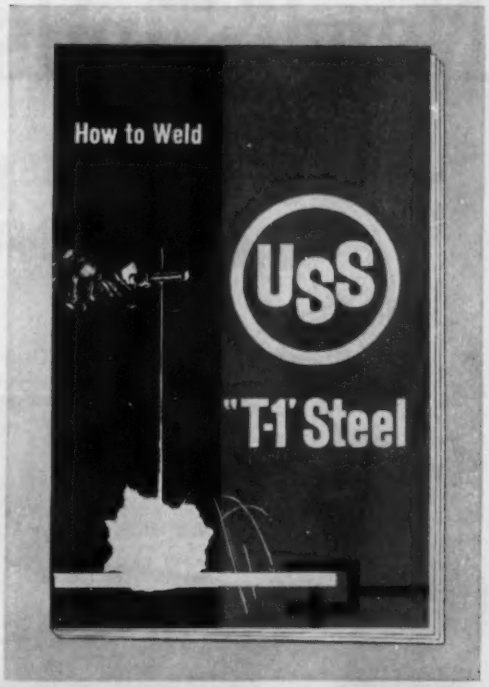
As the booklet points out, welding of USS "T-1" Steel is not particularly difficult—but it is different than welding most other high-strength structural steels. To do it correctly requires some basic knowledge of the metal, of the electrodes, and the proper welding procedures.

We'll gladly send you enough free copies of the booklet for your weld shop personnel. Just send the coupon.

USS and "T-1" are registered trademarks

United States Steel Corporation—Pittsburgh
Columbia-Geneva Steel—San Francisco
Tennessee Coal & Iron—Fairfield, Alabama
United States Steel Supply—Steel Service Centers
United States Steel Export Company

United States Steel



United States Steel
525 William Penn Place, Room 6187
Pittsburgh 30, Pa.

Gentlemen:

Please send me_____ copies of your 24-page booklet, "How to Weld USS 'T-1' Steel," including the handy heat input calculator.

Name_____

Title_____

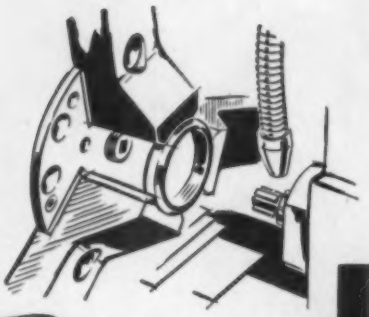
Address_____

Company_____

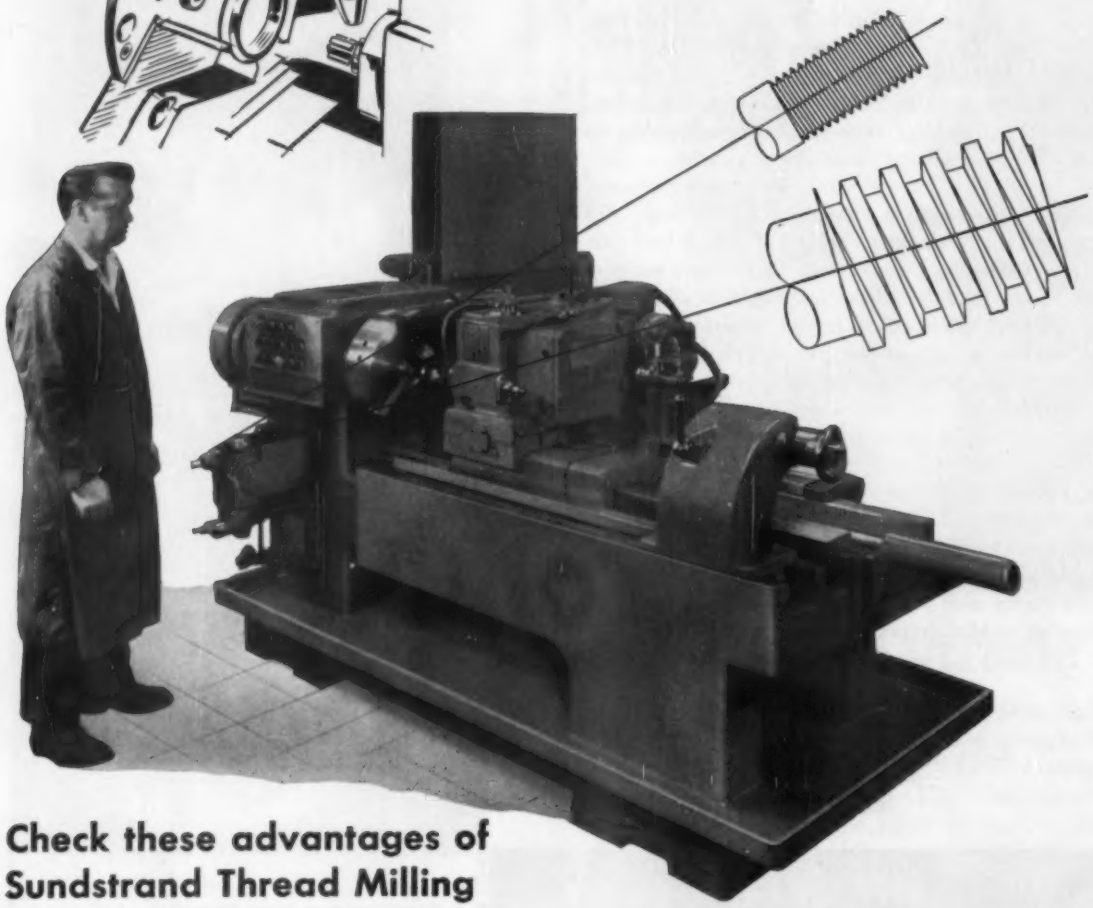
City_____ Zone ____ State_____

• 306 •

New Sundstrand Machine

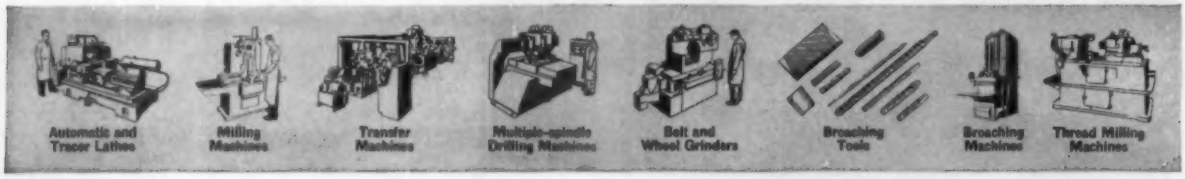


The cutter rotates as it feeds full thread depth into the rotating workpiece. While the workpiece makes one revolution, the cutter is moved lengthwise the exact amount of lead required.



Check these advantages of Sundstrand Thread Milling

- Mills internal or external threads . . . right or left hand . . . straight, tapered or special . . . with any lead up to ½".
- Produces internal or external threads on interrupted work surfaces, such as splines, key slots and flutes.
- Machines thread pitches too coarse to be practical for die or tap cutting.
- Produces faster at lower cost than single-point tools, disc cutters, grinding wheels, or previous thread milling machines.
- Makes external threads one pitch away from a shoulder, internal threads one pitch from the bottom of a blind hole.
- Accurately relates pitch diameters to other elements of the workpiece.
- Mills threaded and plain diameters simultaneously.
- Simultaneously mills two threads of the same pitch and lead on the same or different diameters.
- Threads workpieces of various diameters with a single cutter.



Simplifies Thread Milling

features sine bar adjustment for threads up to ½" lead, fully automatic cycling, and five minute change-over.

The new Sundstrand Universal Automatic Thread Milling Machine speeds production, insures accuracy, and minimizes scrap loss on a wide range of threading operations, including those difficult, costly, or impractical by any other method.

The machine employs multiple thread cutters having no lead but with the desired pitch and thread form. The new and exclusive sine bar mechanism is dial-adjustable to provide an infinite range of thread leads of 0 to ½".

Because there are no gears or cams to change for different thread leads, change-over to a new part is fast and easy. Setup can be completed in about five minutes after the cutter and part are placed in position, making the machine ideal for short or long runs on a wide variety of parts.

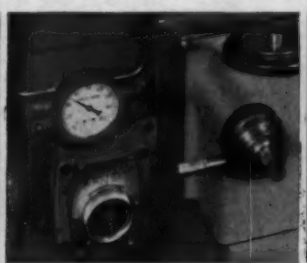
No special operator skills are required to consistently mill high-quality uniform threads — the machine easily produces to the exacting requirements of military and aircraft specifications.

Four models are available to handle workpiece lengths up to 24", 48", 72", and 96". Various optional accessories include: Taper cutting attachment to mill any thread taper up to .100" per lead; automatic or manual facing attachment for turning shoulders and faces square with the thread pitch diameter; power positioning unit which moves the cutter head longitudinally to speed setup when handling a variety of part lengths; tailstock for external work; steady rest for 1" to 6" diameter parts.

For complete information and specifications, write for new Bulletin 620.

SINE BAR DIAL ADJUSTMENT, graduated in increments of .0002", provides any lead up to ½", including specials.

DIAL-ADJUSTED CUTTER HEAD. The cutter head is easily positioned and clamped longitudinally on the ways and transversely across the ways by dial adjustment.



INFINITELY VARIABLE FEED. During setup and automatic cycle, the feed is infinitely variable from 1/15 rpm to 6 rpm by adjustment of the feed control.

ADJUSTABLE CROSS TRAVEL. Total cutter head cross travel of 1-3/8" (including 3/8" max. feed) can be easily adjusted to the proper setting for any part.

SUNDSTRAND

SUNDSTRAND MACHINE TOOL

BELVIDERE, ILLINOIS • DIVISION OF SUNDSTRAND CORPORATION

INSTANT KEYWAYS

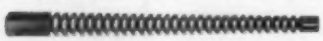
for a penny apiece

With Minute Man Keyway Broach Kits you can cut keyways in one minute for as little as one cent. For keyways from 1/16" to 1" in any bore from 1/4" to 3".

SAVE TIME WITH THESE OTHER STANDARD STOCK BROACHES

Minute Man®

SQUARE BROACHES
For finishing 1/8" to 3/4" square holes in one pass in cast or drilled bore.



HEXAGON BROACHES
For finishing 1/8" to 3/4" hexagonal holes in one pass in cast or drilled bore.

ROUND BROACHES
For finishing 1/4" to 1" round holes in one pass in drilled bore.

SEND FOR CATALOG AND PRICE LIST

The duMont Corp.,
Greenfield, Mass.

MAIL FREE BROACH CATALOG AND PRICE LIST A describing Square Broaches, Hexagon Broaches, Production Type Keyway Broaches and Keyway Broach Kits to

Name .....
Company .....
Address .....

duMont

LETTERS

to the editors

330 W 42nd St, New York 36, NY

Next Inventory?

Dear Sirs:
We are interested in knowing whether or not AMERICAN MACHINIST/METALWORKING MANUFACTURING is going to publish another *Inventory of Metalworking Equipment* similar to the one published in 1958.

We should be pleased to know when this is being published again and to go on record as requesting a copy. On the other hand, if you have the data now, we would be pleased to have same.

G Jank
Beverly, Mass

The Inventory *is published once every five years. That means that the next one, the ninth, is scheduled to appear in the latter part of 1963*—Ed.

Horsepower Formula

Dear Sirs:
We have been following your discussion of horsepower as applied to an operation on a 75-hp lathe. This problem was concluded in "Talking Shop" (*AM/MM*—Sept 5 '60, p143).

Will you kindly send me the horsepower formula that was used for calculating the estimated horsepower?

William G Saville, *tool engr*
Atlas Press Co
Kalamazoo, Mich

We're sorry to say that the problem was not concluded in the Sept 5 issue, but the following letter should help to bring this matter to a close:

Dear Sirs:
It was with keen interest that I read the item entitled "Horsepower Formula" . . . You have undoubtedly received comments on this, so perhaps the following has already been covered. Nevertheless, the metal removal rate (MRR) relationship which exists is:

$$MRR = 12 \times V \times F \times d$$
$$= \text{cu in. per min}$$

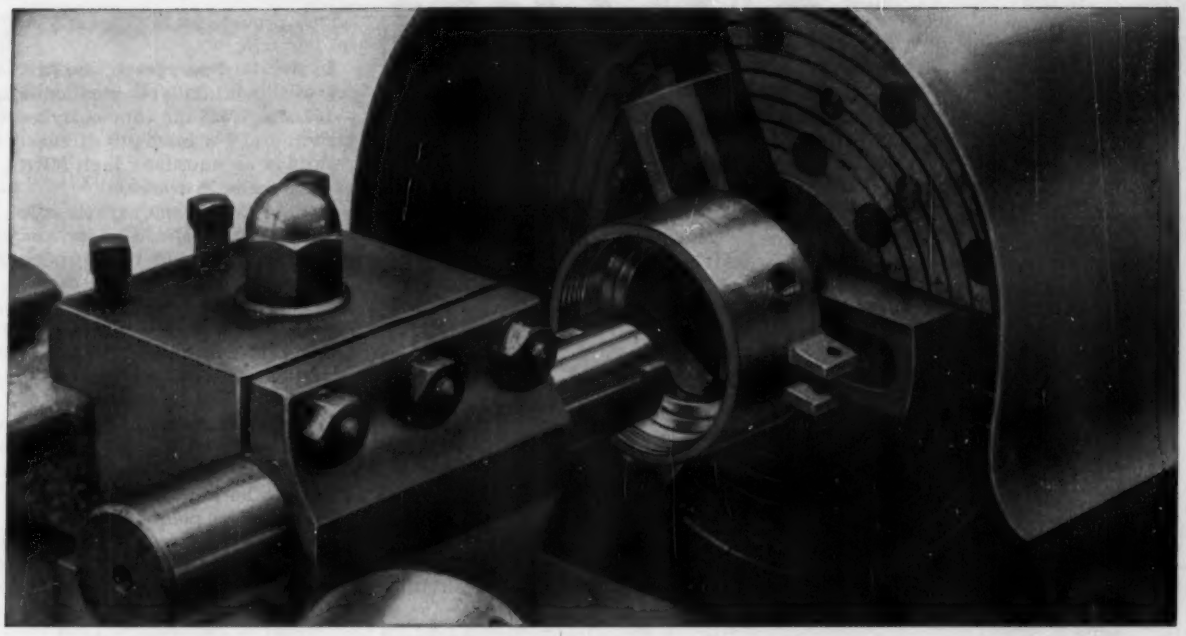
Where:
MRR = metal removal rate
12 = ft to in. conversion
V = surface speed—fpm
F = feed—in. (per rev)
d = depth of cut—in.

In your Sept 5 issue, the machining conditions listed in the first paragraph were 288 sfm, 0.0835 ipr, and 1.0 in. depth of cut,

SHOPMATES

N. Jarvis

PIPE DOWN!! QUIET!!
YOU GUYS SOUND LIKE A SEWING CIRCLE! NO MORE TALKING AROUND HERE!!! NEXT GUY I CATCH TALKING I'LL ···· ····!
···· AND A FEW MINUTES LATER ····
HEY HERM!! HOW'S TRICKS? WHAT'S NEW? HOW'S THE WIFE? HOW'S THE KIDS? HOW'S EVERYTHING? WHO'S ON FIRST? WHAT'S TRUMP? ETC ETC ···· BLA BLA ···· ETC ETC ····
SEALED LIPS
N. JARVIS



Threaded in just 6 seconds on a Gisholt CRI-DAN

Here's a good example of what you can do on a Gisholt CRI-DAN Threading Lathe—an internal thread, 2 3/16" diameter x 1/4" long, 12 t.p.i., cut in a phosphor-bronze bearing housing in just six seconds.

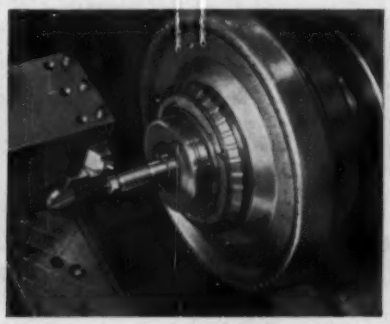
Speed and versatility obsolete other methods.

Note the other jobs shown—the variety of work and the fast threading times. Simple on a CRI-DAN—yet, each presented problems that could only be solved at high cost using any other method.

It's Cri-Dan for highest quality, lowest cost.

The jobs shown here prove that close tolerance and high-quality finish requirements are met easily on the CRI-DAN. The CRI-DAN method, using an inexpensive single-point carbide tool, is faster and less costly than thread grinding or thread milling.

20 seconds—Zoom operating sleeve for movie camera; aluminum; I.D. pilot dia. bored; tool indexed for threading a 2-start, .0625-pitch, .125"-lead, Class 4 16NS thread in the 1.610" center section.



15 seconds—spinning roller; stainless steel; 18 t.p.i. thread on 5/8" diameter for 7/8" length.

GET THE FACTS—NOW! Two models are available—both are capable of handling high-production work or a wide variety of short-run jobs. Change-over averages ten minutes. Write for our catalog—or ask your Gisholt Representative for complete details.

GISHOLT® MACHINE COMPANY

Madison 10, Wisconsin

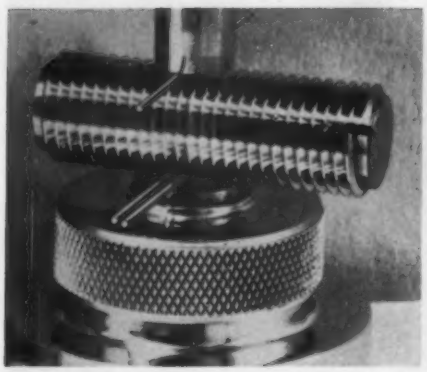
Investigate Gisholt's Extended Payment and Leasing Plans

Turret Lathes • Automatic Lathes • Balancers • Superfinishers® • Threading Lathes • *Factory-Rebuilt Machines with New-Machine Guarantee*

WHY YOU NEED

VK CALIBRATED THREAD WIRES

41st YEAR



VAN KEUREN STANDARD 60° THREAD MEASURING WIRES ARE NOW CALIBRATED TO WITHIN .000005" OF EXACT SIZE AT NO EXTRA COST.

THIS PREVENTS THE LOSS OF SUBSTANTIAL PORTIONS OF YOUR PITCH DIAMETER TOLERANCES.

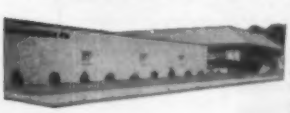
CONSIDER

With VK *Calibrated* Wires:	With *Uncalibrated* Wires:
Maximum deviation in wire size as shown on label = .000005"	Maximum deviation in wire size as shown on label = .000025"
Maximum error in measurement of 60° Threads due to wire deviation = .000005" x 3* = .000015"	Maximum error in measurement due to wire deviation = .000025" x 3* = .000075"
For a 3/8-24, Class W, Thread Gage the pitch diameter tolerance is .0001". Thus maximum measurement error using *calibrated* wires is 15% of pitch diameter tolerance.	Note here that the error in measured pitch diameter using *uncalibrated* wires could be 75% of the total tolerance allowed for the pitch diameter of the 3/8-24, Class W, Thread.

**Change in Measurement for 60° threads = Change in Wire Diameter x (1 + cosec 30°)*

CAN YOU AFFORD TO GAMBLE PART OF YOUR PITCH DIAMETER TOLERANCE ON UNCERTAINTY AS TO THE TRUE DIAMETER OF THE MEASURING WIRES?

Wouldn't it be a good idea to send us your uncalibrated or worn thread measuring wires for calibration and replacement where necessary? Liberal allowance will be made on uncalibrated wires toward the purchase of new calibrated wires.



THE VAN KEUREN CO.
173 Waltham Street, Watertown 72, Mass.
PRECISION MEASURING TOOLS
. . . rated the world's most accurate

Plug Gages • Measuring Wires • Optical Flats and Light Wave Equipment • Gage Blocks
Precision Lapping Service and Parts

which provide an MRR of 288 cu in. per min.

In the third paragraph, the first set of conditions you mentioned —150 sfm, 0.835 ipr (obviously an error), and 1⅜ in. depth of cut— results in an unusually high MRR of 2060 cu in. per min.

In the fourth paragraph, the conditions of 330 sfm, 0.064 ipr, and 1.0 in. depth of cut result in an MRR of 254 cu in. per min as opposed to the 204 cu in. per min stated. (Since the horsepower meter read 105 hp for this set of conditions, the unit horsepower is therefore: UHP = 105 hp ÷ 254 cu in. per min = .414 hp per cu in. per min.)

The above comments are not intended to be critical but are supplied merely to point out what appears to be an error.

James M Galimberti, *project engr*
Kennametal Inc
Latrobe, Pa

Why not be critical?—Ed.

Cavity Inspection

Dear Sirs:

Would it be possible to receive additional details on your "Metalworking Report" item, "Inspection . . . Industrial inspection kit . . ." (*AM/MM*—Oct 17 '60, p3)?

You have indicated that this kit is available from Ellis Optical Co in England.

C Miller
Pittsburgh, Pa

We do not have any further information on this inspection kit, so we can only suggest you write the manufacturer: Ellis Optical Co, Mayday Road, Thornton Heath, Surrey, England—Ed.

"I gave up being efficient — couldn't get anything else done."

CALENDAR

Joint National Symposium on Reliability and Quality Control, Jan 9-11, Bellevue Stratford Hotel, Philadelphia, Pa.

Society of Automotive Engineers —International Congress and Exposition, Jan 9-13, Cobo Hall, Detroit, Mich.

Instrument Society of America—Instrument-Automation Conference & Exhibit, Jan 17-19, Kiel Auditorium, St Louis, Mo.

Plant Maintenance & Engineering Show—Jan 23-26, International Amphitheatre and Palmer House, Chicago, Ill.

Society of Plastics Engineers—Annual Technical Conference, Jan 24-27, Shoreham Hotel, Washington, DC.

Society of the Plastics Industry —Reinforced Plastics Div Conference, Feb 7-9, Edgewater Beach Hotel, Chicago, Ill.

Material Handling Institute — Pacific Coast Show, Feb 22-24, Cow Palace, San Francisco.

American Institute of Mining, Metallurgical, & Petroleum Engineers—Annual Meeting, Feb 26-Mar 2, Chase-Park Plaza Hotel, St Louis, Mo.

Society of Automotive Engineers —National Automobile and Production Meetings, Mar 13-17, The Sheraton-Cadillac, Detroit.

American Society for Metals — Western Metal Show, Mar 20-24, Pan-Pacific Auditorium, Los Angeles, Calif.

Pressed Metal Institute — Spring Techincal Meeting, Mar 22-24, Belmont Plaza Hotel, New York.

Society of Automotive Engineers —National Aeronautic Meeting, Apr 4-7, Hotel Commodore, New York, NY.

American Welding Society—Annual Meeting and Welding Show, Apr 18-20, Commodore Hotel and Coliseum, New York.

American Foundrymen's Society —Castings Congress & Exposition, May 8-12, Brooks Hall and Civic Auditorium, San Francisco, Calif.

MILLING ALUMINUM!

The best way to cut **ALUMINUM,** is with CARBIDE!

Carbide cuts faster, smoother, cooler and is much more economical, especially when milling **ALUMINUM!**

NELCO manufactures 121 different, "standard", off-the-shelf End Mills engineered for milling **ALUMINUM!**

ALUMINUM is a relatively soft material but it is one of the most abrasive.

Cutting tools that are not designed to mill **ALUMINUM** can make production very expensive.

NELCO manufactures the most complete variety of Carbide Cutting Tools, engineered to mill **ALUMINUM** and they are available through your Local Distributor.

INDUSTRIAL DISTRIBUTORS THE RIGHT HAND OF PRODUCTION

Send for Catalog Today

More End Mill Production . . . Less Initial Cost

Save 20% with THRIFTMILLS®

For that EXTRA Edge in Production!

Brown & Sharpe CUTTING TOOLS

NELCO

NELCO Tool Co., Inc.
Subsidiary of:
Cutting Tool Division
Brown & Sharpe Mfg. Co.
Providence 1, Rhode Island

NEW HUGHES MT-3
AUTOMATES JOB LOT PRODUCTION

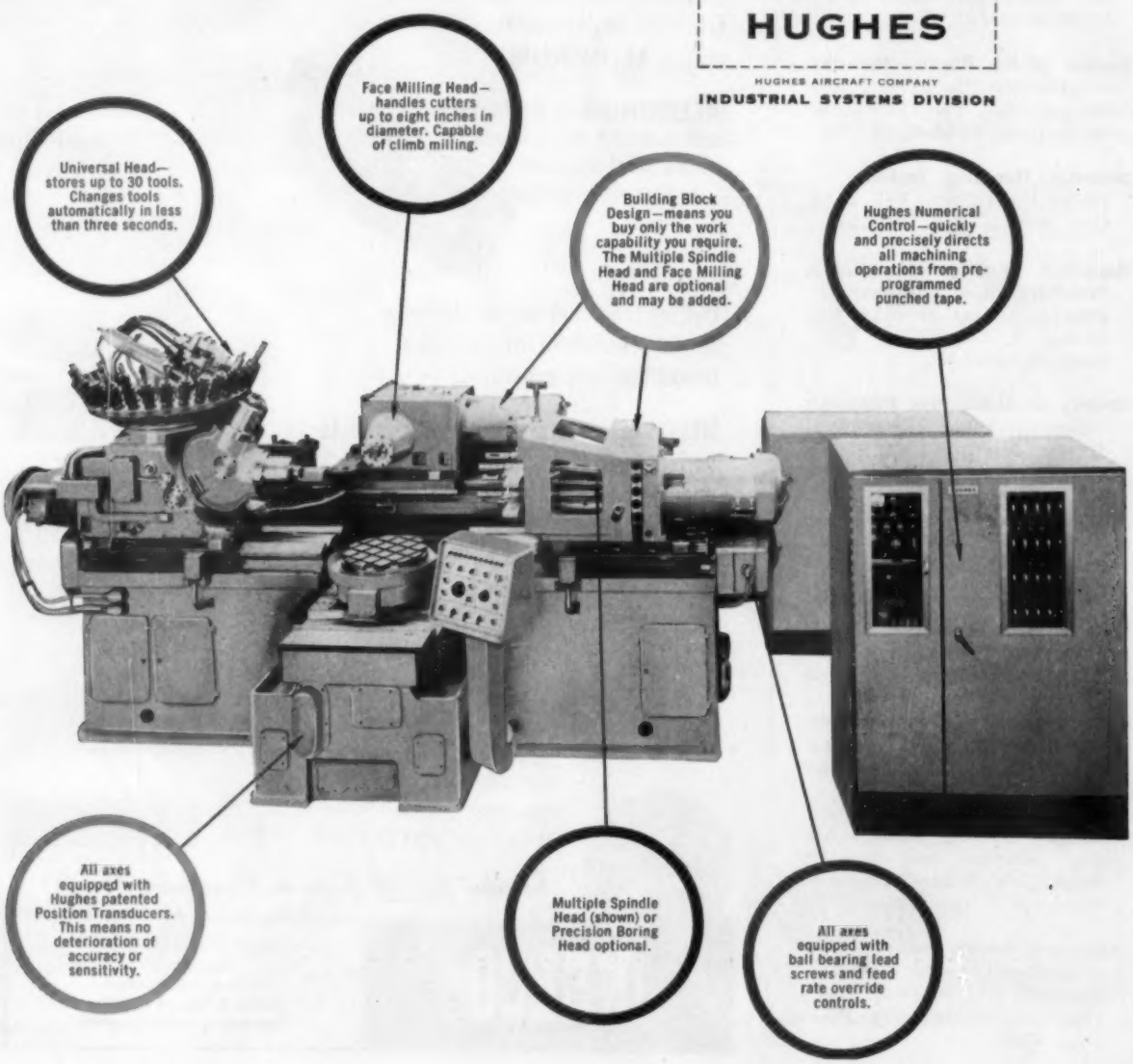
The new Hughes MT-3 replaces from three to six conventional machines. It drastically reduces costs by bringing production line efficiency to small lot manufacturing of parts requiring face and other milling operations, drilling, boring, reaming and tapping. Operating from numerical instructions programmed on tape, the system functions completely automatically. The MT-3 has an absolute positioning accuracy of ±0.0005". Its part size envelope is a twelve-inch cube, but in many cases will machine parts up to 12" x 24" x 24".

For complete engineering specifications, firm price and delivery dates write, teletype (TWX INGL 4117) or call collect: HUGHES INDUSTRIAL SYSTEMS DIVISION, P. O. Box 90904, Los Angeles 45, California.

CREATING A NEW WORLD WITH ELECTRONICS

HUGHES

HUGHES AIRCRAFT COMPANY
INDUSTRIAL SYSTEMS DIVISION


Universal Head—stores up to 30 tools. Changes tools automatically in less than three seconds.
Face Milling Head—handles cutters up to eight inches in diameter. Capable of climb milling.
Building Block Design—means you buy only the work capability you require. The Multiple Spindle Head and Face Milling Head are optional and may be added.
Hughes Numerical Control—quickly and precisely directs all machining operations from pre-programmed punched tape.
All axes equipped with Hughes patented Position Transducers. This means no deterioration of accuracy or sensitivity.
Multiple Spindle Head (shown) or Precision Boring Head optional.
All axes equipped with ball bearing lead screws and feed rate override controls.

SPOT NEWS...

- **International Harvester will produce a "compact, all-purpose vehicle"** to be known as the Scout. Expected to go into production next spring, the Scout will have an integral pickup body, detachable hardtop cab, and detachable doors. It will be available with two- or four-wheel drive, have a wheelbase of 100 inches, and be powered by a newly developed four-cylinder engine.

- **30% stronger aluminum die castings are claimed possible** with a sonic-vibration unit that attaches to the die to shake down and compact the aluminum. The Vibrocast, built by Adams-Millis Corp, High Point, NC, sells for about $350. Technique also reduces internal casting defects. Applications include the casting of aircraft wheels that now must be forged.

- **Japanese machine tool production is expected to reach $250 million in 1962,** over three and a half times the 1959 figure, according to the Japan Machine Tool Association. (For a breakdown of world machine tool output, see p 110.)

- **The current renegotiation law is being studied for possible changes** by the Joint Committee on Internal Revenue Taxation. If you want to get on the record write to Colin F Stam, chief of the committee staff. Sometime before March 31 he will set up staff interviews with company officials who want to be heard.

- **An electrolytic gas cell may bring explosive forming into the shop.** Now under development at Battelle Memorial Institute, the experimental cell generates an oxygen-hydrogen mixture, and is considered a promising fuel source for explosive forming operations and high-temperature welding and cutting torches. An 8 to 1 oxy-hydrogen mixture produces the highest flame temperature, fastest detonation, and greatest pressure buildup when ignited.

- **Carbide "weld-bonded" to unhardened tool-steel shanks takes shock better** than carbide brazed to steel shanks, and costs 2/3 less than solid carbide for punches, slitting rolls, and other tools. Welded Carbide Tool Co, Clifton, NJ, has been making special tools with practically any grade of carbide, but with special shock resistant tool steel. Next development will be production of shaped punches and dies by electrical discharge machining.

- **Bullard has licensed Kirloskar Brothers Ltd, South Satara, India,** to build Bullard vertical turret lathes and horizontal boring machines. The Indian firm will also act as sales agent for other machines in the Bullard line.

- **Double-declining balance depreciation is being used by 47%** and sum-of-the digits by **36%** of members of Research Institute of America who replied to a questionnaire identical with that being circulated by Treasury Department. Half the members call present allowances inadequate. Majority are willing to give up capital gains on sales of depreciable property to extent of depreciation previously deducted if they get a more adequate system. Most prefer to set their own useful lives and depreciation methods on a consistent basis.

- **The ASME's Blackall Machine Tool and Gage Award** was presented this year to J Boaz Popper, project engineer, Scientific Dept, Israel Ministry of Defense, and David W Pessen, lecturer in the Mechanical Engineering Dept of the Technion, Israel Institute of Technology, for their paper, "The Twinworm Drive — A Self-Locking Worm-Gear Transmission of High Efficiency." The award was made at the ASME's Winter Annual Meeting in New York.

- **A titanium alloy with 8% Al, 1% Mo, 1% V looks promising for jet engines,** according to Titanium Metals Corp. Now under test, the alloy seems suitable for compressor disks, blades, and other stressed and loaded parts. It has good creep resistance, usable tensile strength to 900 F, and is lighter than most commercially available titanium alloys because of the high aluminum content.

A REPORT

on the superior tailor-made qualities of

G-E MAN-MADE DIAMONDS for METAL BOND WHEELS

A COMPARISON

In the electrolytic grinding of more than 311,000 miscellaneous carbide tools, six metal-bond wheels containing General Electric's latest type MBG Man-Made Diamonds were given a direct comparison to six wheels containing natural diamonds. The result shows a 22.5% superiority of G-E Man-Made Diamonds over natural diamonds.

Diamond Type	No. of Wheels	No. of Tools Ground	Avg. Wheel Wear Inches	Avg. Cu. In. Carbide Removed	Avg. Cu. In. Carbide Removed Per Cu. In. Wheel Wear	Efficiency Ratio
G-E MBG	6	160,713	.0605	90.885	70.2	122.5
Natural	6	150,496	.0644	80.181	57.3	100.0

A CONCLUSION

This comparison between G-E type MBG Man-Made Diamonds and natural diamonds is but one example of the superiority of this crystal developed specifically for metal-bond grinding wheels. The announcement of this new, blocky, tougher crystal, in 80-mesh and finer, with rough surface characteristics, was made by G.E. in April of 1960. In this short time reports reveal that MBG diamonds have shown outstanding results, not only in electrolytic grinding, but in the grinding of sapphire, slicing and dicing of germanium, cutting coarse-grained alumina and carbides.

Your own tests will demonstrate the worthwhile advantages of these new industrial diamonds in your metal-bond grinding operation. Call your grinding wheel supplier today. Metallurgical Products Department of General Electric Company, 11149 East 8 Mile Street, Detroit 32, Michigan.

METALLURGICAL PRODUCTS DEPARTMENT

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WASHINGTON...

Eisenhower's budget plans...

The Eisenhower administration's final military budget, for the fiscal year beginning next July 1, will schedule a boost of at least $1 billion in spending over the current $41.5-billion expenditure rate. Requests for new appropriations are expected to total close to the $41.2 billion voted this year.

That's the word from Pentagon insiders. They call the new defense budget a "tight one," and say Eisenhower has ordered the Defense Department to hold spending down as firmly as possible. The President is determined to come up with a balanced federal budget. He wants to send his own kind of military program to Congress next month—which would represent a continuation of his past policies—then let Kennedy take the responsibility for overhauling it.

Says one administration insider: "The last Eisenhower military budget will be tighter than if the Republicans had won. We don't have to accommodate to Nixon's views now." His point is this: Nixon had much to do with the relaxation in the Pentagon's budget ceilings of the past several months and the increase of roughly $500 million in new contracting schedules since the July political conventions.

The proposed rise in spending next year under the Eisenhower plan does not involve any important new program expansions beyond those already in the works. The added outlays will mostly cover built-in cost increases for programs such as Polaris, Titan, and Minuteman. Much of the increase will also cover the extra costs for personnel and operations just to maintain present force levels.

Paper-shuffling?...

But many Washington officials consider Eisenhower's defense budget preparations as just so much paper-shuffling.

The military services anticipate getting additional funds from the Kennedy administration, and have ambitious shopping lists to offer the President-elect. Included are projects chopped out of the new budget by Eisenhower's spending restrictions.

Kennedy is expected to submit a supplementary appropriation request for the current fiscal year within a month or two, then to come up with a revised version of Eisenhower's budget for the year beginning July 1. In all, these could add some $2 billion for new procurement and R&D contracts in calendar 1961.

Top priority projects, Kennedy advisers say, are these: expansion of the Polaris and Minuteman missile programs, a continuous airborne B-52 alert, and modernization of airlift and combat equipment for ground forces.

Cut in procurement appropriations

Military producers are under new pressures to curb costs on weapon projects. Procurement agencies are tightening up on audits of cost estimates made by contractors, taking a closer look on selection of subcontractors by major primes, and are prodding contractors into greater production efficiencies.

Behind the new concern over costs is the recent 3% across-the-board reduction in procurement appropriations made by Congress for the current year. The cut was made to stimulate the military into tighter control over costs without reducing quantitative purchases. The Congressional action, in turn, was generated by recent GAO reports of excessive costs on important projects.

Liberalized depreciation...

President Eisenhower's Commission on National goals has come up with proposals which read as if they were written by President-elect Kennedy. On balance, the report's tone is on the side of bigger government and more spending in national policy in the years ahead.

One of the report's key proposals: An overhaul of depreciation allowances as a means of accelerating industrial investment. Special attention is urged for policies favoring "completely new ventures which involve a high degree of risk."

Du Pont president Crawford H Greenewalt, one of the Commission's members, spells out the tax proposal this way: "Depreciation policies . . . should be modified to permit rapid amortization of new plant and equipment. This will encourage industry to undertake needed amortization and, more importantly, will facilitate entirely new and risky ventures with high growth potential." He also wants to "abate the steep progression in personal income taxes" to find the funds for faster growth from "bold new discoveries."

Significantly, AFL-CIO president George Meany, another Commission member, doesn't say no on these points. But he does criticize the report for "grudgingly" recognizing the federal government's role in economic areas.

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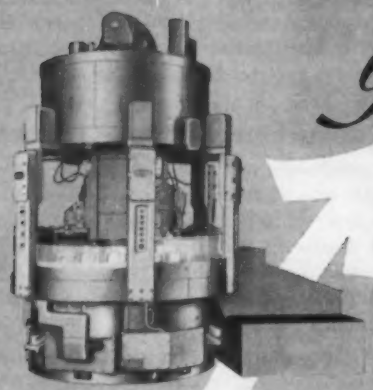

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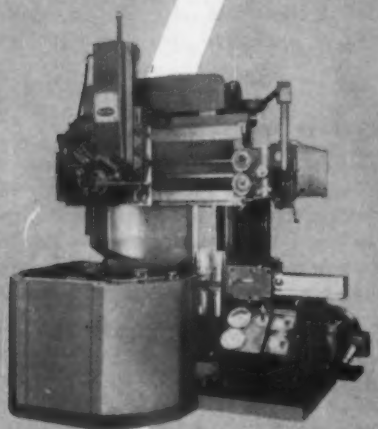

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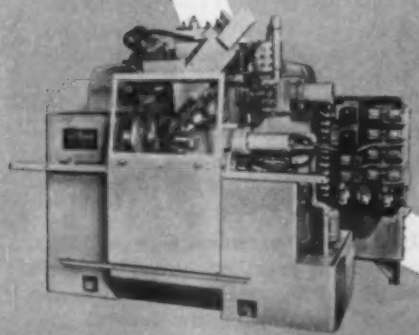

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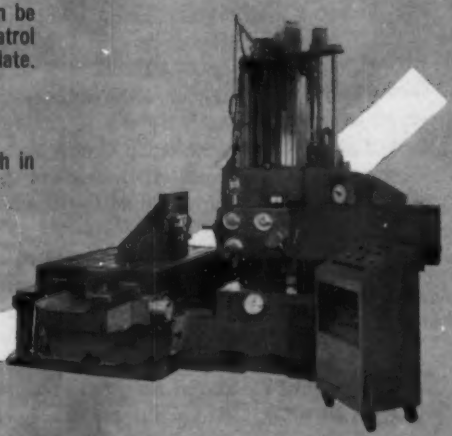


TRENDS

DETROIT...

Fourth-quarter record...

The domestic auto industry now expects to sell nearly 1,600,000 passenger cars this quarter. If these dreams come true, it will mean the best fourth quarter on record since 1955 when 1,617,000 units were delivered.

Despite a sound overall market, some makes are not faring too well. November saw the last DeSoto produced, ending a 32-year life-span for that make. Also, rumors that the name will be continued next year as a sports-type car are being discounted in industry circles.

Studebaker continues on a four-day week, as do various Chrysler Corporation plants. General Motors name-plates, on the other hand, are all selling well although comparisons with 1959's steel-short fourth quarter cannot be fairly made.

GM's three new compacts are achieving good consumer acceptance. Approximately one Tempest and Special are built to every three of the respective parent makes, and most of it seems to be plus business. Oldsmobile has about the same ratio, with a production pace of about 2700 F-85's a week compared to 7800 standard size models.

More consolidation?

The demise of DeSoto is looked upon as one more step towards consolidation of Chrysler Corp's multi-headed sales organization. Next move, with a timetable of mid-1961: merger of Plymouth with the Chrysler-Imperial Division.

Reasons make economic sense. Plymouth and Dodge are outfits that can normally sell about 400,000 vehicles each a year. Thus they can afford high-powered, full-time sales organizations stretching from factory to field level. The present Chrysler Division, however, can hope at best to move about 100,000 units, but with this smaller volume, it still must employ a complete complement of sales personnel.

Even existing Chrysler Corp Divisions in recent years have become nothing more than sales organizations housed in plants run by corporate manufacturing personnel. The division general manager once rated a corporate vice-presidency and a seat on the board. Now he is sales manager —period—for the line concerned, and some recent incumbents with talents in other directions have had their problems.

The various Chrysler-made cars stress interchangeability of parts. A $5000 Chrysler New Yorker sedan, for example, utilizes the same basic body stampings as a Plymouth. Six and V-8 cylinder engines are shuttled between divisions, differentiated only by the decalcomania on the valve cover. Again, it makes economic sense even though copywriters have difficulty proving that the big Chrysler is any more "Lion hearted" than the rest of the line.

Fleet preferences...

Chevrolet defines a "fleet owner" as anyone who possesses ten or more vehicles, and this cagey group of buyers is commonly supposed to insist on utter austerity in transportation. Sales facts, however, do not justify such an assumption.

Four-door sedans by far out-sell the cheaper two-door models. Extra-cost V-8 engines are chosen by 55% of fleet buyers. 92% insist on factory-installed heaters, and 34% add radios. In Texas, 75% of all fleet sales include an air-conditioning apparatus. But perhaps the best example is the fact that 51% of Chevrolets sold to them sport whitewall tires.

Cultivating the junkyard...

It may be hard to believe, but Ford Motor Company this year will gross $90 million through sale of rebuilt automotive parts. These items, marketed through dealer channels, range from carburetors to complete engines, and they carry guarantees only slightly less advantageous than the factory-new equivalent.

Now Chrysler is entering this field, and like Ford, operations are not restricted to the family. Both companies will rebuild and sell each other's engines.

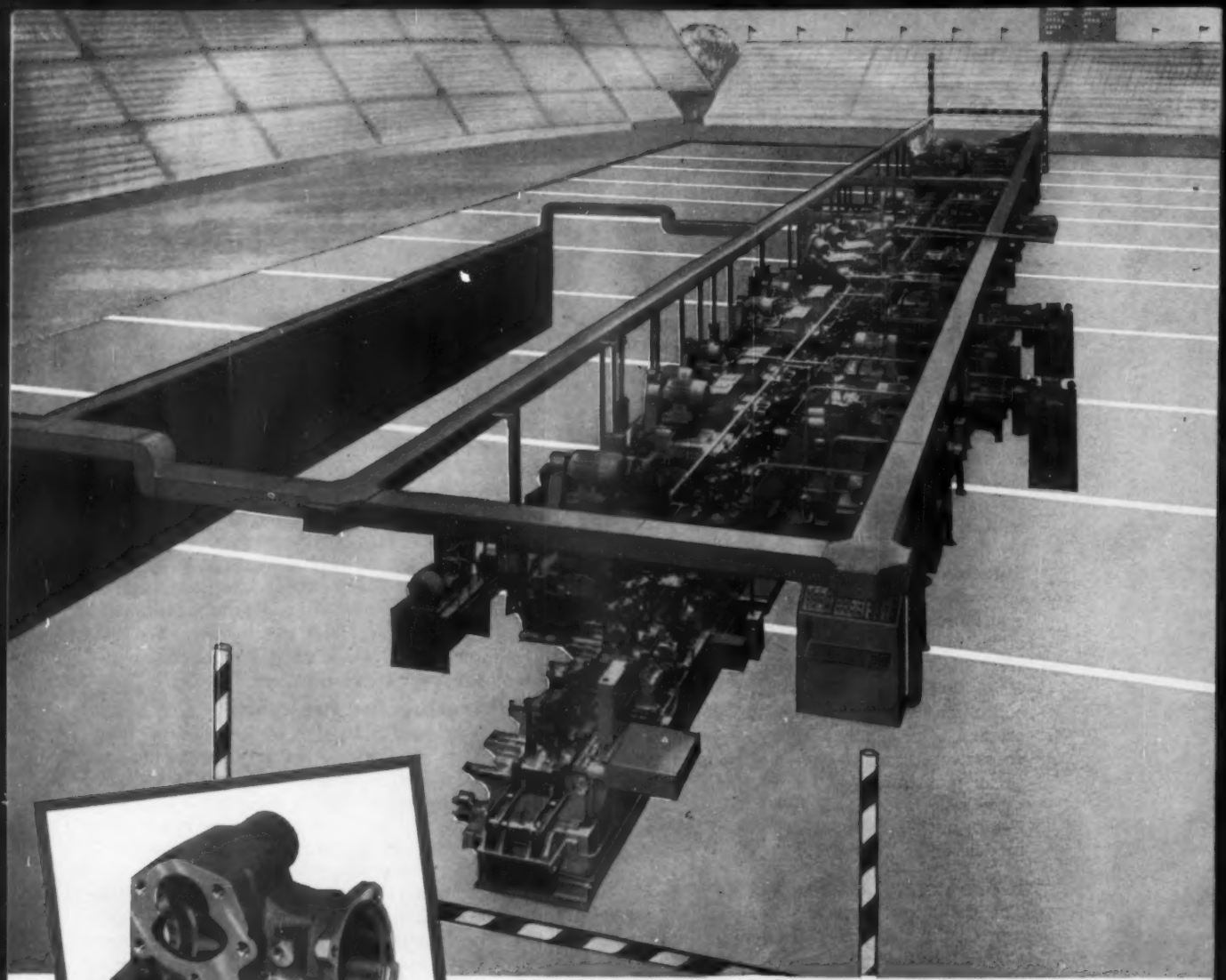
The actual rebuilding is performed by carefully selected, independent contractors and, as during the war with toothpaste tubes, to get a new carburetor, you have to turn in your old one.

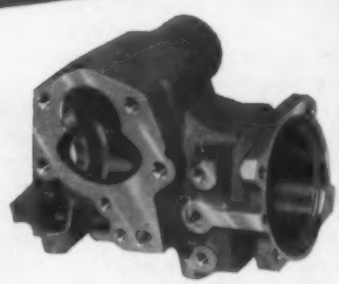
Builders of garage gear, such as reboring machines, valve grinders and the like, are eyeing the development cautiously. Chrysler's five newly contracted rebuilding centers, to be sure, will have to invest heavily to set up an assembly-line-type operation. But what happens to bread and butter sales of equipment to fleet owners who may abandon their own overhaul facilities in favor of the new service?

Watch those claims...

Back in September of this year, the Pontiac people launched their "revolutionary" compact Tempest with the claim that it was [and here we quote directly from the press release] "the first American car to achieve the idyllic front engine-rear transmission arrangement so important to be a perfectly balanced automobile." This corner with faith passed on news of the innovation, as did most other technical journals, only to arouse a host of graybeards who remembered the EMF, circa 1909. Oh well, caveat emptor.

—Don MacDonald





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Ed: This looks good to me - let's discuss it - JB.

CIRCLE 327 READER SERVICE CARD

AIRCRAFT and MISSILES... TRENDS

Procurement costs still high...

Though much has been done in recent months to bring procurement costs into line, the Air Force still has a number of problem categories and is still encountering a so-what attitude among some contractors, according to Lt Gen M E Bradley, Jr, deputy chief of staff for materiel.

The problem categories include:

- Overstatement of costs in incentive type contracts. In some cases, over-pricing has amounted to as much as 15-20%.
- Use of unreasonable low target figures on cost-plus-fixed-fee contracts "in order to get a foot in the door."
- Poor decisions on "make-or-buy." Some firms have tooled up and made parts which they could have obtained more cheaply from another source; others have bought parts which they could have produced at less cost and with no unwarranted drain on their facilities.
- Too many sole-source subcontracts. More competition would cut costs and spread the business.
- Contractor attitude. Some make all-out efforts to reduce costs, but others take a so-what attitude and do nothing.

Congress has ordered the Defense Department to report by January 1 on improvements that have been made in cost control, and has pointed out that contracting officers will be called to explain any case where mismanagement is evident.

Missile defense group set up...

A special technical advisory group for ballistic missile defense has been set up by the Advanced Research Projects Agency in cooperation with Stanford Research Institute, Lincoln Laboratories, Cornell Aeronautical Laboratory, and the Willow Run Laboratory of Univ of Michigan.

Primary purpose of the group will be to provide advice and recommendations on various aspects of ARPA's project Defender. Defender is an advanced research program aimed at discovering adequate means to counter operational ballistic missiles.

Space Plane proposals submitted...

Design proposals for the development of the Space Plane vehicle have been submitted to the Air Force by Lockheed, Republic, Boeing, Convair, and Douglas. The Air Force is asking for $20 million in its fiscal 1962 budget for studies of this manned, winged vehicle, which would fly both in the atmosphere and in space.

Plastic rocket casing...

The Navy is using a fiberglass-reinforced plastic as a casing for the Polaris solid-propellant rocket engine. First successful test of a missile using the new casing was made a few weeks ago at Cape Canaveral.

It marks a revolution in materials engineering, with the development of a new construction material for the missile industry, says the Navy.

Up to now, all rocket chambers were fabricated from titanium, steel, or aluminum. The new material consists of continuous glass filaments surrounded by a flexible resin. The filaments are wound on a mandrel which has the configuration of the rocket chamber.

The new material has a high strength-to-weight ratio, and is an important element in the Navy's success in increasing the range and payload of the Polaris. The Navy's Allegany Ballistics Laboratory, Cumberland, Md, (operated by Hercules Powder Co) developed the material.

How to get that contract...

West Coast electronics manufacturers were told that they would have to increase their bidding activity and sharpen their pencils if they were to capture a larger share of the procurement dollars spent by the U S Army Signal Supply Agency.

The West Coast has 25% of the nation's electronics industry, but only 15% of the dollar value of the agency's open contracts are spent there, said Brig Gen Charles S Hayes, chief of USASSA, at a meeting sponsored by the Los Angeles Chamber of Commerce.

USASSA awards about 60,000 contracts annually, spending in excess of $500 million. To get your share of these contracts, the General advised, "You are encouraged to participate in our procurement program by making your bids competitive, keeping our bidders' information file up to date with data on your new capabilities and products, and by utilizing our bidders' information facilities."

Participation in R&D work may, in many cases, serve as "the key to production contracts," he said.

A panel discussion following the General's talk stressed the importance of submitting Form 129 and keeping it up to date, inasmuch as lists are processed mechanically on the basis of information supplied on this form. Incompleteness or absence of the form will reduce a manufacturers chances of appearing on rotating bid lists.

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CIRCLE 328 READER SERVICE CARD

TRENDS

MACHINE TOOLS...

Auto makers to buy presses...

Large orders for presses are expected from the auto industry next year, on top of heavy orders from Detroit in recent weeks.

One major car maker plans on buying a substantial number of presses for 1962 model programs. Another will be making purchases for replacement of outmoded presses.

Press builders have a good volume of business, and expect more, from European auto companies.

Net new orders for cutting-type machine tools from foreign buyers have represented almost one-third of total bookings in the June-October period. For the first 10 months of 1960 the ratio of foreign orders to the total was 28%.

Orders from Europe to continue...

Much of the overseas business has come as a result of inability of European builders to meet reasonable delivery dates. Prospects are that this situation will not change for some time, so orders from foreign customers should continue in 1961 to be high in relation to total bookings of U S builders.

West Germany's machine tool industry has recently attained an all-time peak in new orders which for the year 1960 probably will hit $700 million. Deliveries of general-purpose machines now range from six to ten months, and of special machines and elephant machines up to two-and-a-half years.

Brazil has risen to first place alongside France as West Germany's best foreign customer. This year it has bought DM 23 million of metal-cutting machines and DM 15 million of metal-forming machines from West German builders. Orders from Japan have amounted to DM 34 million, and from China DM 24 million.

British machine tool industry is equally prosperous with the German. Its order book at the end of September stood at $314 million, of which $65 million was for export.

Chrysler to order for engine line...

Chrysler is reported planning to send out requests for quotations for a production line for its new die-cast, six-cylinder aluminum engine. American Motors is said to be looking into machines for a line to make aluminum heads to replace the cast-iron head now used on its six-cylinder aluminum engine. The Chevrolet buying program for its new six-cylinder engine for the Flint plant is believed to be little more than talk and probably won't result in any machine tool orders until tooling for 1963 models gets under way.

Truth about Russian orders...

Two of the five U S machine tool builders named by Stankoimport as having received orders for Soviet delivery deny having them. The two are Norton and Ex-Cell-O.

Gleason has an order from Russia, but reports that Washington has turned down its application for an export license for shipment of the order.

Jones & Lamson and Bryant Chucking Grinder have orders from Moscow on their books and are said to be in the process of filling them.

There is considerable speculation about the reason for the disparity between the news announced by Stankoimport and the actual facts. And no clear-cut explanation is available.

The federal government has severely tightened its export licensing policy for shipment of machine tools to Russia. It is doubtful, in fact, whether any new export licenses for machine tools will be granted during the remaining days of the Eisenhower administration.

No one knows for sure what the attitude of the Kennedy administration will be. But experienced observers are of the opinion that the present stringent policy is likely to be relaxed.

They cite the fact that those who recently have been denied export permits have been advised to apply again in 45 to 60 days.

Russian prices unacceptable...

Stories are going the round that at least two U S builders have been proffered orders by the Russians at prices too low to be acceptable. Still another U S builder is unwilling to take a Russian order for special machines because Moscow will not agree to make progress payments.

An ever-increasing number of U S machine tool builders are making the trek to Moscow in search of orders. The feeling is growing within the industry that Washington's policy toward shipment of U S machines to the Soviet bloc should be relaxed, and that American companies should be allowed to ship the same types of machines that our allies are, without harrassment.

A West European machine tool builder, incidentally, has received an order for about 150 turret lathes from Yugoslavia.

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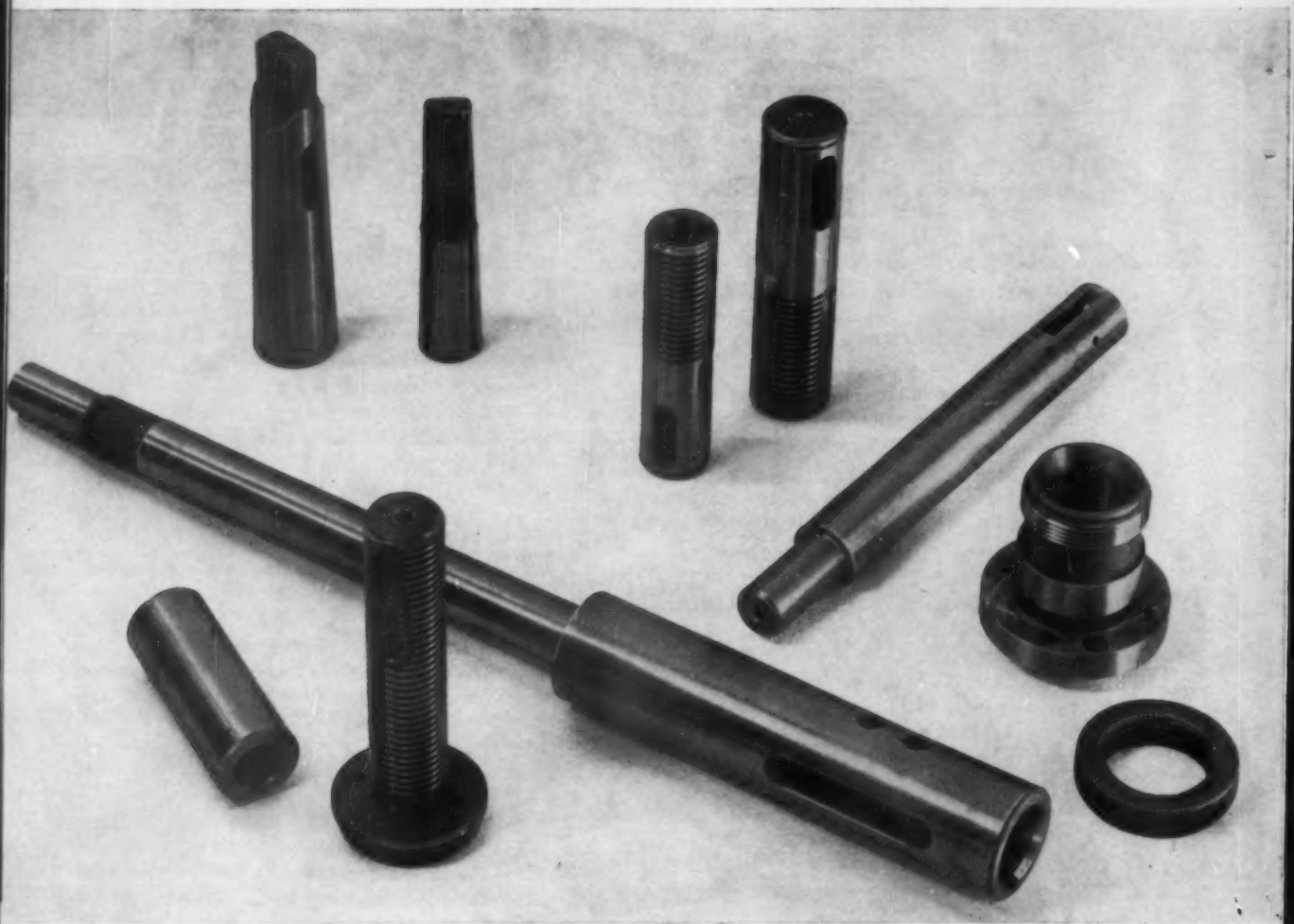
This mark tells you a product is made of modern, dependable Steel.



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Why USS Free-Machining Steels offer more. Good steelmaking practices are the rule at United States Steel. Close control of chemical balance, rolling and finishing practices, and high inspection standards are combined to produce a bar stock of *consistent* high quality.

Both USS Leaded Steels and the well-known MX Brand of Free-Machining Steels are produced in open-hearth and Bessemer grades, in all screw-stock sizes.

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Watch United States Steel's special Christmas show, **The Coming of Christ**, in Color on NBC-TV, Wednesday, December 21, 8:30 P.M., E.S.T.

TRENDS

MATERIALS...

More on iron from copper slag . . .

Prototype test runs of ironmaking using waste copper slag from the pile of the Anaconda Company in Anaconda, Montana are being made at the Niagara Falls, Ontario, plant of Strategic Materials Corp. These tests are a significant step toward completion of Webb & Knapp's 1000-ton-per-day steel mill at Anaconda, Montana.

Within a few months after the prototype plant operation, it is expected Koppers Co of Pittsburgh will complete engineering studies of the costs and operations procedure of the proposed plant. Then financing and construction schedules will be established. Koppers Co is designing the mill for Webb & Knapp Strategic Corp. It is expected to cost from $30 million to $40 million and be in operation during the last half of 1963. Construction should begin next spring.

Building the first mill in Montana is a change in the original plan (AM—Oct 5 '59, p73). Webb & Knapp had planned to build the first mill at Clarkdale, Arizona but, as mentioned last year, was disappointed in the high cost of electrical power. Federal power is being obtained in Montana for about two mils a kilowatt, far below the Arizona rates. Studies show that if power costs can be brought even slightly under six mils per kilowatt, steel produced in Arizona could compete effectively in the nearby southern California market.

Montana-produced steel will compete in a broad area — including Canada and the West Coast. Webb & Knapp has contracted with Anaconda Co to purchase slag from the 40-million-ton pile at Anaconda, plus all future slag output being added to the pile from the copper company's large smelter, at the rate of 25c per ton.

Direct reduction takes power . . .

When copper is removed from copper ore, the value of the metal left in the residue, or slag, is three times the worth of the copper removed. Until now, it has not been economically practical to recover that metallic value because the recovery process costs more than the recovered metal was worth. Most copper ore contains more iron than copper.

The Strategic - Udy direct - reduction process makes recovery of this iron, plus other metals, profitable. At copper-smelting locations all over the world there are tremendous slag piles—hundreds of millions of tons — hence this process could be an important factor in the world steel picture. One important requirement is economical fuel and power. Low power rates in the Northwest are one key to the expected economies of the Montana mill.

For the reductant, natural gas has been considered but present tests are being run with anthracite coal. Since December 1, some tests have been conducted with lignite (brown coal) as the "fuel." Strategic Materials Corp also plans, for another purpose, to test coconut shells as reductant. If successful, this test might make production of ferro-chrome practical in the Phillipines. Webb & Knapp is concentrating on the copper slag potential of the Strategic-Udy process. Other firms will be licensed to use the process for other metals from other sources.

Break-even at 50% . . .

The break-even point of the proposed plant at Anaconda, Montana, is estimated at 45 to 50% of capacity, without considering the value of by-products. (One by-product, the "slag-slag" remaining after the iron is removed, is said to be an excellent aggregate for road and building products.) One-third of the steel-producing capacity is already contracted for on a sliding-scale price, based on the market price of steel. The $2 billion Columbia River power projects may provide a major local market.

Not the final answer . . .

Is "direct reduction" the answer to tomorrow's ironmaking? We asked several technical specialists in the industry this question. Their answer: No. "Direct reduction holds great potential value," they said, "but it isn't the ultimate answer."

The ultimate goal some scientists and engineers are hotly pursuing is distillation — fractional distillation of vaporized ore — to separate out exactly the desired metal with a minimum of impurities. In plasma we have the source of heat. Now we need the vessel to contain, and condense, large volumes of metallic vapor at 7000 F. It may not be so many years away. One thing seems certain: In the very near future we shall have better materials than are necessary for most of the commercial products in which they will be used. Consistency will be one important quality, available in more and more metals right now, which will offer outstanding benefits in machine and formability. The real challenge is to engineers to make better use of the benefits metallurgists offer.

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all drive screws in center of guideways for best accuracy, least wear

tape is read during positioning; no delays

simple switching from tape to pendant controls

heavy-duty, rigid structural design

repeatability within plus or minus .0001"

wide range of sizes, both table or floor type

14 reasons to consider tape-controlled Gilberts

Summarized here are the main reasons you should consider Cincinnati Gilbert's numerically-controlled 4" and 5" horizontal boring mills. We suggest a letter or phone call for complete information—or, better yet, a visit to the plant to see an actual demonstration. The Cincinnati Gilbert Machine Tool Co., 3366 Beekman Street, phone Kirby 1-4815, Cincinnati 23, Ohio.

GILBERT

WHAT'S AHEAD... in Metalworking

TRENDS

Metalworking production holds steady . . .

Metalworking production continues at an even pace. All segments of the industry report that business is slow, the outlook cloudy, with little chance of any major upturn within the first quarter of 1961.

Steelmakers report continued soft demand for mill products. Despite the fact that the consumption rate is still about 10-15% above the current steel production rate, there has been no indication of inventory buying by customers.

One large mill reports that orders now coming in for January delivery are running about 5% ahead of the same period a month ago. But most observers see little hope for a pickup before February.

Sheetmetal shops are operating at a slower pace and expect this trend to continue through year's end. Many companies report sales for the year down as much as 33% from 1959. Hand-to-mouth buying is hurting production in this industry, as well as in many others.

A bright light in the home appliance industry is the 10-15% decline in distributor inventories. Several manufacturers report production off 10% this quarter, and they expect the year as a whole will end up about 10-15% below 1959.

Though their business continues at "good" levels, auto parts producers complain that the heavy proportion of compacts being made has cut into business volume. Detroit is still not buying for inventory. One major producer, looking to 1961, sees a slow first half, with continued pickup through the second half, and year-end results slightly ahead of 1960 sales.

Metal stampers expect 1960 sales to equal those of 1959, but with a decrease in earnings. One stamper says there are rumors of late but heavy tooling orders for 1962 model cars, plus some talk that the appliance industry will do some major re-tooling for their 1962 models. The same source says there is reason to believe that there will be a recurrence of a heavy cycle of tooling orders coming later than usual in 1961.

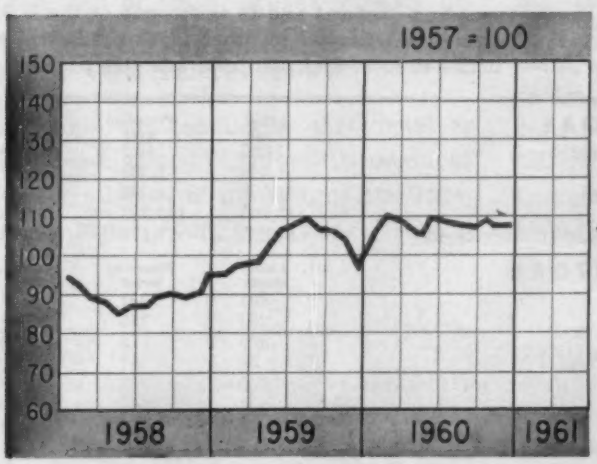
Producers of screw machine products report business is down 10-20% from last year at this time. Though there are no indications that an upturn is imminent, producers forecast some improvement during the second quarter of 1961 when, they feel, the demand for consumer durables should pick up.

Steel foundries were operating at 45% of maximum commercial demand, according to the latest monthly report from the Steel Founders Society. Bookings of new orders were at about that 45% rate also. Changes in operating rates have been small, and the prediction is that 1960 tonnage will equal 1959's. The founders expect to ship about 1.4 million tons of end product this year.

Production of gray iron castings rose in the latest month, with operations running at 66.6% of rated demand. 1960 operations are expected to be slightly below those of 1959.

Welding supply sales are up about 7% over 1959, according to the latest report of the National Welding Supply association.

The American Gear Manufacturers Association booking index for the latest month is 197.9 (1947-49 = 100), a drop of 22.6% from the previous month.



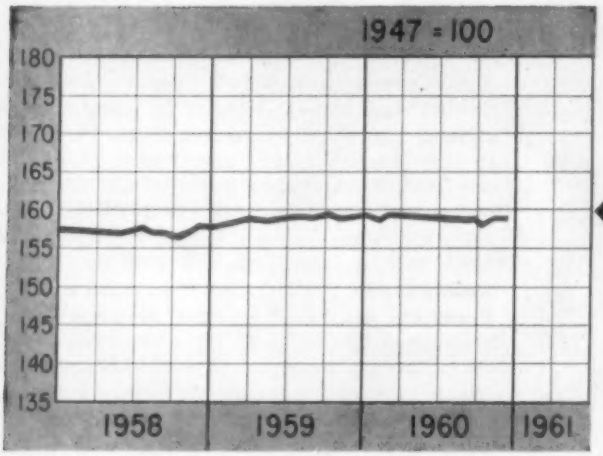
AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

106

	NOV Estimated	OCT Preliminary	SEPT Revised	OCT Year Ago
Total Index	**106**	**106**	**107**	**103**
Machinery	**103**	**106**	**103**	
Electrical Machinery	**108**	**112**	**112**	
Autos	**120**	**117**	**103**	
Other Transportation	**90**	**89**	**91**	
Other Metalworking	**109**	**109**	**104**	

TRENDS WHAT'S AHEAD... in Business



159.6

AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	NOV Estimated	OCT Preliminary	SEPT Revised	OCT Year Ago
Total Index	**159.6**	**159.4**	**158.2**	**159.5**
Metalworking Machinery	**193.3**	**193.3**	**188.6**	
Other Machinery exc. Electrical	**173.3**	**173.1**	**171.7**	
Electrical Machinery	**158.7**	**158.7**	**162.4**	
Fabricated Metal Products	**147.4**	**145.2**	**148.3**	

The U S balance of payments . . .

Recent fluctuations in the price of gold have renewed concern over the international standing of the U S economy, as reflected in the U S balance of payments (the sum of our international trade and financial transactions). However, a close look at developments affecting U S international economic prospects is reassuring.

U S commercial exports (sales of non-military goods abroad) have increased sharply. For 1960, exports are 22% greater than for 1959. U S imports of foreign goods, meanwhile, have declined.

In part, this brightening picture is the result of special circumstances that aren't likely to recur next year. Exports of U S aircraft soared this year, as foreign airlines converted to jets. Exports of raw cotton, abnormally low in 1959, jumped this year in response to an increased government subsidy to exporters. And steel exports, cut last year by the strike, rebounded strongly.

Unmistakably, though, the U S export position has improved. Since the introduction of compacts, autos are getting a warmer reception overseas. Significantly, U S machinery exports also are gaining.

Many European countries have reduced or abolished import restrictions on U S goods. This reduction in trade barriers came during a European economic boom, when the need for U S products was great. It thus was a key factor in the growth of U S exports.

Offsetting these gains in exports of U S goods is a continued high level of government spending (military as well as economic aid grants) in foreign lands, as well as considerable U S private investment abroad.

However, recently announced government actions — including efforts to reduce military spending overseas and to shift some of the U S foreign aid burden to other industrialized nations—if successful, will alleviate this problem.

WEEKLY BUSINESS INDICATORS

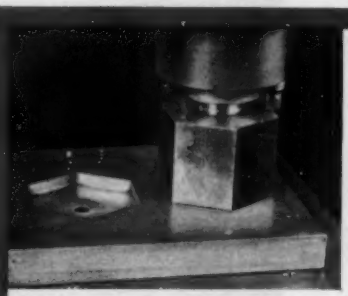
	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-49 = 100)*	143.3	144.3	150.9
Steel ingot production (thousand tons)	1,404	1,367	2,650
Electric power output (million Kilowatt hours)	13,500	14,042	13,173
Production of automobiles	113,705	149,753	46,740
Engineering construction awards (Eng. News-Record, thousands)	81,202	77,170	69,114

MONTHLY BUSINESS INDICATORS

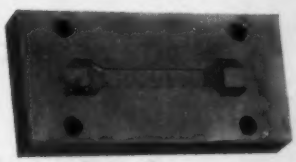
	Latest Month	Preceding Month	Year Ago
Refrigerators sales (thousands of units)	301	291	314
Vacuum cleaners sales (thousands of units)	281	223	268
Washers sales (thousands of units)	296	175	359
Household electric ranges sales (thousands of units)	66	57	61
Radio production (thousands of units)	708	955	1,009
Television production (thousands of units)	462	269	547
Gear sales index (1947-49 = 100)	255.8	217.5	213.3
Foundry equipment new orders index (shipments, 1947-49 = 100)	158.1	92.4	134.1

*Seasonally adjusted

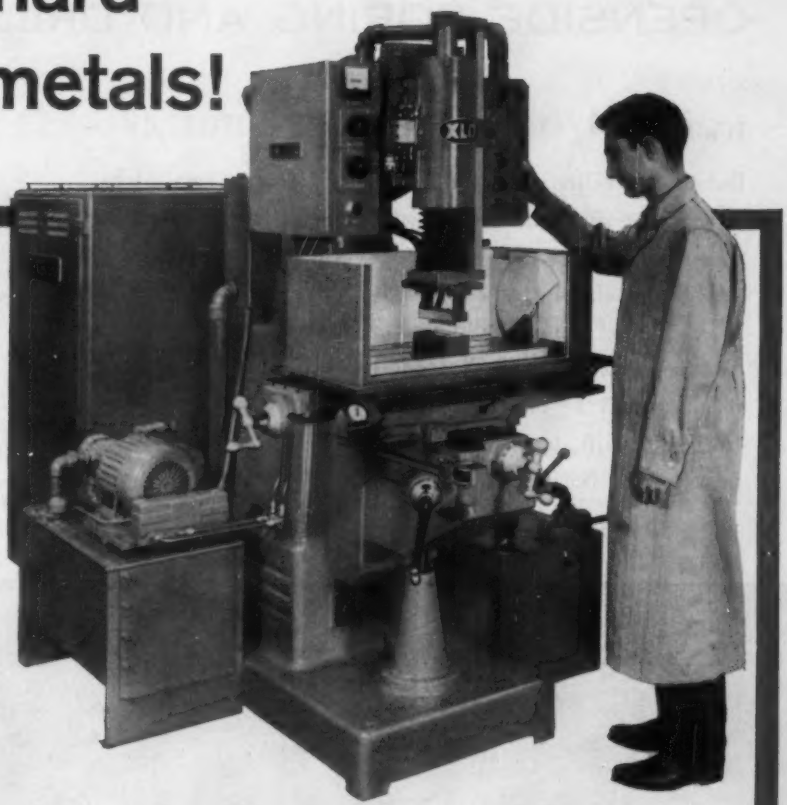
LECTRA-FORM...The easy, low-cost way to cut hard and tough metals!



Lectra-Form produces an accurate, inverse image of the tool with a fine, uniform matte-type finish.



This wrench die was machined by Model 244 shown at right. Removable front panel of dielectric tank simplifies loading.



If the material you're working conducts electricity . . . you can drill, tap, pierce, trepan, slot or cut it, or sink intricate die cavities in it with LECTRA-FORM, the all-new Ex-Cell-O Vertical Electrospark Machine!

Using low-cost, conductive sheetmetal or tubing for tooling, LECTRA-FORM produces an inverse image of the tool, or electrode, through high-current, low-voltage electrical spark discharge. There is no tool pressure, no heat.

Standard Model 244 features include four-way slide positioning and vertical knee movement, automatic tool feed and gap distance control, front-load work tank, plus graduated dials for work positioning, a power supply cabinet and dielectric fluid storage tank.

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60-79

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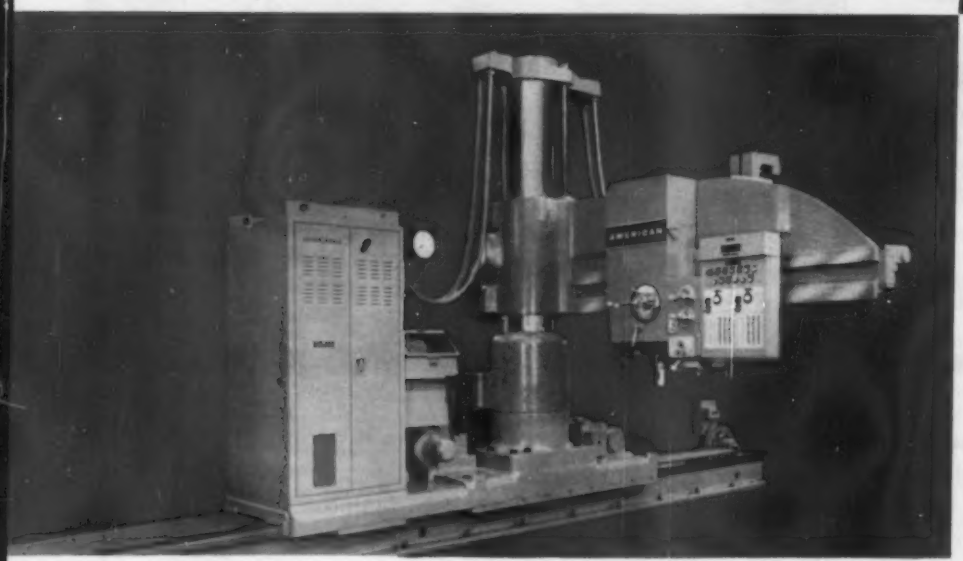

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To Insure the Nation's Future Growth

The President's Commission on National Goals, in its recent report, made the sound pronouncement that "the economy should grow at the maximum rate consistent with primary dependence upon free enterprise and avoidance of marked inflation."

To insure the nation's future welfare and growth the Commission favors, among other things, an overhaul of the federal tax system, including depreciation allowances. It forthrightly declares that the climate for new investment should be improved. It seeks to encourage "completely new ventures which involve a high degree of risk and growth potential."

The Commission does not spell out its ideas about depreciation allowances. But Crawford H Greenewalt, a Commission member, states his views thusly: "Depreciation policies . . . should be modified to permit rapid amortization of new plant and equipment. This will encourage industry to undertake needed amortization and, more importantly, will facilitate entirely new and risky ventures with high-growth potential."

The facts support . . .

the Commission's recommendation, and Mr Greenewalt's in particular. Today more than three out of every five machine tools installed in America's vast metalworking industry are ten years old or older and hence are obsolete in design and performance. They are incapable of meeting current standards of efficiency, of precision manufacture and of low costs so necessary to high productivity. This in the face of the availability of new machines embodying the most far-reaching changes in technology in history.

Production and installation of new machine tools is an accurate barometer of the rate at which new manufacturing technologies are being adopted. Yet we as a nation are trailing badly where once we were the leader.

A new world study made by the European Committee for the Cooperation of the Machine Tool Industries reveals that in 1959 Soviet Russia turned out 160,000 new machine tools, West Germany 120,000, and even Communist China 75,000. Our machine tool industry built only 65,000. This year's figures will show us in even a worse position.

Russia obviously realizes that production and use of new machines in prodigious numbers help to build a strong industrial nation. West Germany has the same set of values. And so does China. Oddly, our own government, operating in what we think is the most highly developed and sophisticated industrial society in the world, is the only major power that apparently does not subscribe to this sound policy.

Before it is to late . . .

Washington should awaken to the reality that economic growth and increased productivity cannot be achieved by maintaining a tax policy that discourages rather than encourages investment by industry.

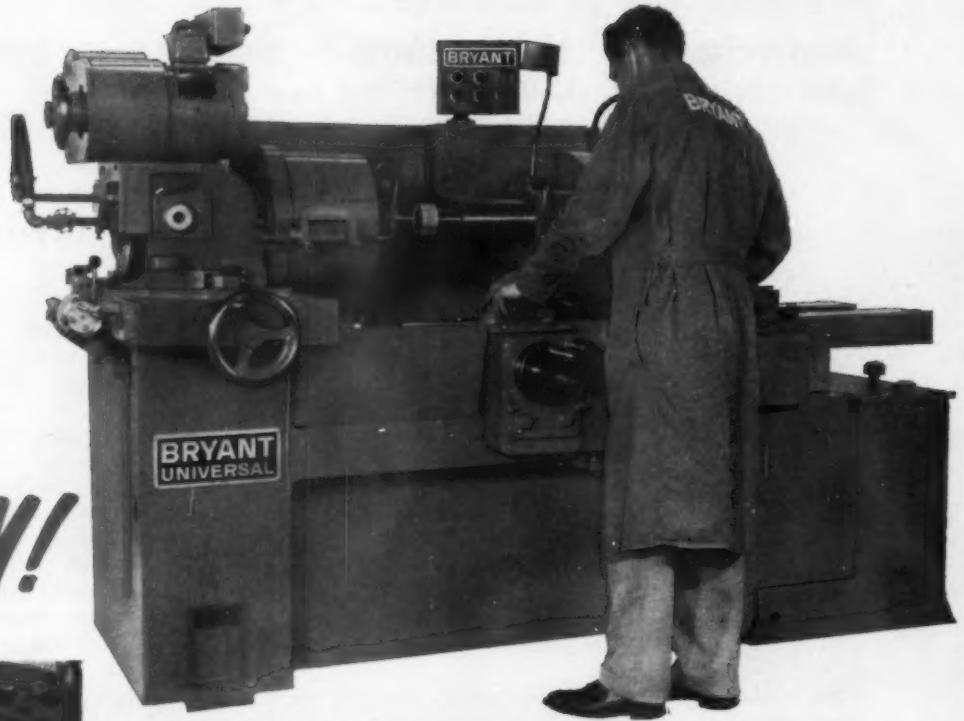
There is a crying need for depreciation reform. The British, Germans, French, Swedes and Canadians hold out attractive tax inducements to their manufacturers to invest in the new technology. Washington meanwhile finds a dozen reasons why nothing should be done to junk our antiquated depreciation rules and regulations.

But there is hope. President-elect Kennedy already has given lip service to the principle of depreciation reform. He could do nothing more constructive in the early days of his administration than to put the full weight of the White House behind a program of legalizing rapid amortization of new plant and equipment.

Only if such an enlightened policy . .

comes into being can our economy sustain the maximum rate of growth that the President's Commission seeks and thereby "move toward our goal of full employment, to provide for the 13.5 million new additions to the labor force the next ten years, to improve the standard of living, and to assure the United States competitive strength."

Burnham Finney EDITOR



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Internal Grinders • Special Machinery

How to select an adjustable-speed drive

By John W Harper, equipment industries engineering section, General Electric Co, Schenectady

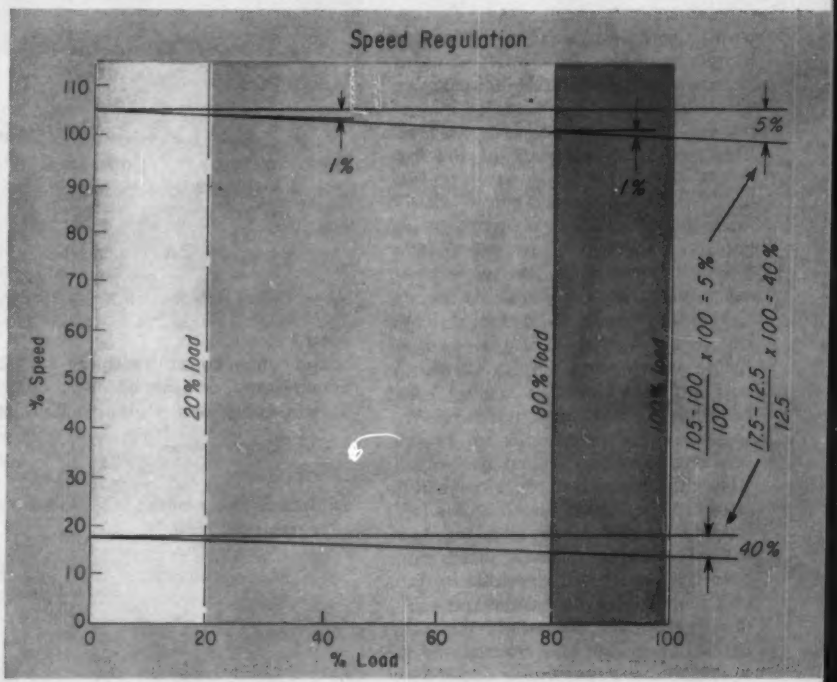
DC motors are usually the best choice to provide machine tools with the flexibility needed to meet varying loads, speeds, and feeds. But AC is the standard current practically everywhere in this country, and it must be converted to direct current before such a motor will work.

This is the job for adjustable-speed drives. But the machine-tool designer, or the shop switching over to DC machine-tool motors, must choose from at least nine types.

While adjustable speed drives *can* operate directly from DC power (the simplest of these is a shunt-wound motor powered by the shop's DC bus line, and with speed control in the field-weakening range only), by far the greater number work on converted AC. Some drives operate from AC through eddy-current couplings, others through adjustable-speed mechanical transmissions. The latter do not require DC motors.

A metallic rectifier drive corresponds to a simple DC motor that has only shunt field control. The rectifier supplies the motor armature (at constant voltage) and the motor field (at variable voltage). Such drives are normally furnished as packages.

Where only AC power is available, these drives require some kind of conversion equipment, such as a motor-generator converter, which operates with static field excitation and regulating equipment; electronic rectifier converters such as GE's Thy-mo-trol for wide speed ranges, or a saturable-reactor converter. The latter operates much like a motor-generator set, except that no rotating equipment is included.



Speed regulation of a feed drive is not as important as for spindle drives since the load varies only slightly—perhaps between 80 and 100%. Load variation in spindle drives is much greater, hence speed regulation may be necessary.

Drive method

A shunt-wound DC motor is most commonly applied for adjustable speeds on a machine tool. The basic mechanical formulas are:

$$Hp = \frac{\text{torque} \times \text{rpm}}{5250}$$

$$\text{and } T = \frac{Hp \times 5250}{\text{rpm}}$$

Introducing electrical factors, we have:

$T = I \times F \times K$, where I is armature current, F is field flux, and K is a constant, hence:

$$Hp = \frac{I \times F \times K \times \text{rpm}}{5250}$$

As the motor field is weakened (decreasing flux), the speed goes up. Current and K stay the same, so the HP is constant. Therefore, within the range of field control, the DC motor has constant-horsepower output and makes a good spindle drive. However, speed range is limited to 4:1 or 6:1—though some have been built for 8:1—and this much range may not be adequate.

If armature voltage is reduced, the first three items in the equation stay constant, and the rpm goes down. Thus, HP decreases proportionately with speed, and the result is constant-torque output. Therefore, a DC motor can be applied both for constant-horsepower and for constant-torque drives, depending on whether the field or the armature is controlled.

As previously mentioned, operating requirements call the shots in the selection of an adjustable-speed drive for machine tools. Which of the nine or more types is ultimately chosen depends upon required load, horsepower, speed, etc.

One of the most important of these is spindle load, which because it involves metal removal, requires constant horsepower. Hp required is proportional to metal removal.

HSS tools, for example, work best when taking a heavy cut at low speed, and this requires a given amount of horsepower. Double the speed with the same feed, and the metal removal rate and the horsepower double, too. Triple the speed, and the horsepower is tripled, but by this time the tool has failed. Thus as speed is increased, feed must be decreased to keep metal removal and horsepower fairly constant.

Feed load is different, because it is mainly caused by friction and is thus a constant-torque load. However, feed force is much less than cutting force and is really only a small part of the total motor load.

Load duty vs drive duty

Horsepower capacity alone may govern final selection of an adjustable-speed drive. In the accompanying chart, which lists nine types of drives, there are six possible choices of 5-hp drives, for example, but

only four possibilities for 50 hp.

Except for the metallic rectifier, all of the listed drives basically have constant-torque characteristics, with constant horsepower available in some cases. The metallic rectifier is constant horsepower only. Consequently, when applied to a constant torque load, the duty on it is light. If any such constant-horsepower drive is selected so that its horsepower rating corresponds to the horsepower requirement of the top speed of the load, the drive would be oversize at speeds below maximum (see Fig. 1). But on the other hand, a constant-torque drive on a constant-horsepower load would require too large a drive at all speeds above the constant hp rating (see Fig. 2).

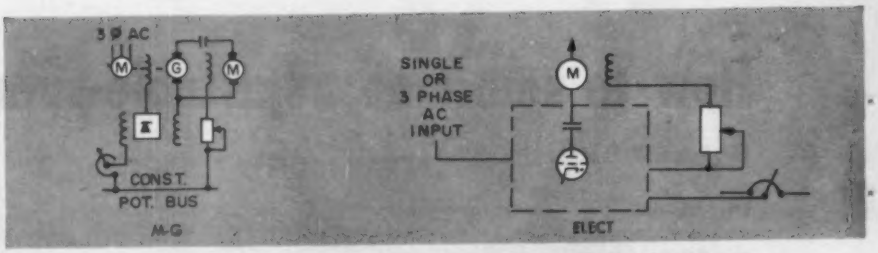
The curve of a DC motor with both armature and field control is a combination of constant torque up to base speed, then constant horsepower above base speed. If an 8:1 constant-torque range is required, eight of the drives listed in table 1 would be satisfactory, depending on the required hp. This could be handled by a drive for constant torque, or by one of the drives that has various degrees of motor-field weakening. The size of the motor would go up as the base speed goes down (See figures 1B, C and D). To get wide feed and speed ranges, the arrangement in Fig 1D is often used, even though the motor is oversize.

Armature control

But suppose a spindle drive requires 8:1 constant horsepower. The motor only has 4:1 field range, so armature range must be employed. If this constant-torque example requires 10 hp at top speed, a motor rated 10 hp would be acceptable. However, if 10 hp constant-horsepower is wanted over the 8:1 range, a motor good for 8:1 field weakening (Fig 2A), or a motor with armature range, must be used.

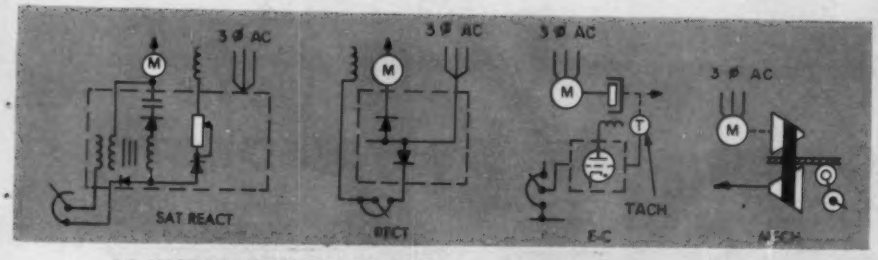
A 4:1 field range and 20 hp at base speed would mean 10 hp at half speed to attain the required constant-horsepower range (Fig 2B). If the drive has no constant-horsepower range, it is necessary to use one rated 80 hp at base speed (Fig 2D) with a suitable power unit. This would rule out all drives except the motor-generator, saturable reactor, and eddy-current coupling types.

Fortunately motor-field weakening is also attainable on the DC drives, so it is possible to go to the 20-hp rating by using 4:1 field weakening, or 40 hp with 2:1 field weak-



CHARACTERISTICS OF

Type	Motor-generator	Electronic rectifier: Fractional hp	Electronic rectifier: General purpose	Electronic rectifier: High performance
Hp ratings	3—500	1/50—1/2	3/4—4	3/4—40
Basic drive	Constant hp, or torque, or both	Constant torque	Constant torque	Constant, hp, or torque, or both
Max starting torque	200%	150%	200%	200%
Speed		(M-Modified)		
Speed range, constant torque	8:1	20:1	8:1	50:1
Speed range, constant hp	to 6:1 (M)	none	none	to 4:1 (M)
Standard regulator	Voltage amplistat with IR comp	Voltage	Voltage—electronic with IR comp	Voltage—electronic with IR comp
Standard steady-state speed regulation	5% base speed	3% / 5%	5%	2%
Std high-performance speed regulator	Amplistat, amplidyne, or electronic	none	Electronic	Electronic
Speed maintenance on overhauling loads	Available as special	Not available	Not available	Not available
Control Features				
Timed acceleration	Standard	NA	NA	As a mod
Timed deceleration	Special	NA	NA	As a mod
Current-limit acceleration & deceleration	As a modification	NA/Std	Std	Std
Reversing while running	As a mod	NA	As a mod	As a mod
Reversible from stop	Mod	Mod	Mod	Mod
Overload protection	Thermal relay	Anode fuse or OL relay	Thermal relay	Thermal relay
Field loss protection	Mod	NA	NA	Mod
Short-circuit protection (primary)	Mod	Separate device	Separate device	Separate device
(drive unit)	Mod	Anode fuse	Anode fuse	Anode fuse
Adjustable jog, inch, creep or thread control	Mod	Mod	Mod	Mod
Adjustable preset speed control	Std	Std	Std	Std
Braking Characteristics				
Dynamic braking	Mod	Std	Mod	Std
Regenerative braking	Mod	NA	NA	NA
Plug braking	Not practical	NA	NA	NA
Mechanical braking	Mod	Mod	Mod	Mod



ADJUSTABLE-SPEED DRIVES

Saturable reactor (magnetic) Fractional hp	Integral hp	Metallic rectifier	Eddy-current coupling	Adj-speed mechanical
1/3–3/4 Constant torque	3–200 Constant hp, torque, or both	1–100 Constant hp	3–100 Constant torque	1/4–25 Constant torque
200%	200%	200%	100-150%	100-150%
8:1 None Voltage amplistat with IR reg	8:1 to 6:1 (M) Voltage Amplistat, IR reg	up to 4:1 up to 4:1 Std NA	to 17:1 None Electronic or amplistat	to 10:1 None NA
5%	5%	5-10%	2% top speed for 75% load change	3% at top speed
None	Electronic or amplistat	NA	NA	NA
Not economical	Not economical	NA	Special Modification	NA
Std Spl	Std Spl	NA NA	Mod Mod	NA NA
NA	Mod	Reduced in-rush starter	Mod	Reduced in-rush starter
NA Mod Thermal relay NA	NA Mod Thermal relay Mod	NA Mod Thermal relay Mod	NA Mod Thermal relay No application	NA Mod Thermal relay No application
Separate device	Std	Mod	Std	Mod
Std	Mod	Fuses	Fuses	Same as primary
Mod	Mod	Mod	Mod	Mod
Std	Std	Std between base & top speed	Mod	Mod
Std	Mod	Mod	Eddy current	Not practical
Not economical	Not economical	Not economical	NA	NA
NA Mod	NA Mod	NA Mod	Spl Mod	Mod Mod

ening, and reduce the size of the power unit accordingly.

Actually, the physical size of the motor might not be too different, whether constant-torque or constant-torque and constant-horsepower ranges were used. Eighty hp at 1800 rpm, for instance, would be roughly the same size motor as 20 hp at 450 rpm. However, the control and the motor-generator set would be much smaller for the second drive, since they would be designed for the base-speed horsepower.

Speed characteristics

Electronic drives are excellent for feed drives. They have the widest constant-torque range, which fits right into the requirements. These high-performance drives can provide a total of 200:1 range, possibly up to 240:1 or better.

Figure 1D illustrates what happens when a combination constant-torque/constant-horsepower drive is applied to a constant-torque load—the motor will have considerably more capacity than required over most of the speed range, since it is above the load curve.

The larger drives would be used for spindles. They have limited speed ranges, but are usually applied with geared-head machines. Also, by properly selecting the drive and fitting it to the load to be handled, combinations of armature and field control can often be used to increase the useful speed range.

Speed regulation

Regulation of most machine-tool drives is not as important as on some other types of machines. However, to get the best results from carbide tools particularly, regulation of not more than 5% is desirable.

On feed drives, regulation is not generally very important. Most of the feed-drive load is the friction in the machine parts, and the cutting load has relatively little effect. Load on such a drive might vary only from 75% or 80% to 100%. On spindle drives the load variation would obviously be much greater.

Speed regulation may be defined as the *steady-state* % change in speed from no load to full load with respect to full load speed, or:

$$\% \text{ regulation} = \frac{\text{RPM no load} - \text{RPM full load}}{\text{RPM full load}} \times 100$$

This is the *steady-state* regulation, and is generally accepted as applying at top speed for adjustable-speed drives. Assume 5% regulation: At no load the speed would be 105%

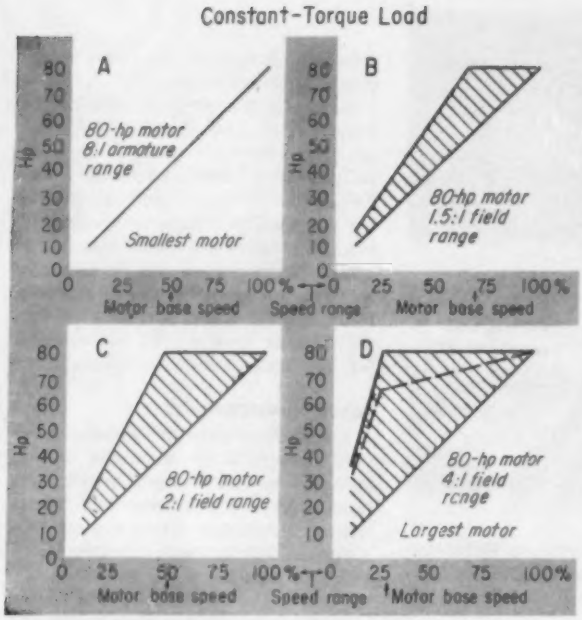


Fig 1—Smallest motor for 8:1 constant-torque load 80/1 HP is obtained with a constant-field, all armature-voltage control. (A) As field control is added, (B&C), motor size increases for same speed range. Example at D is for when a range much wider than obtainable by armature control alone is required.

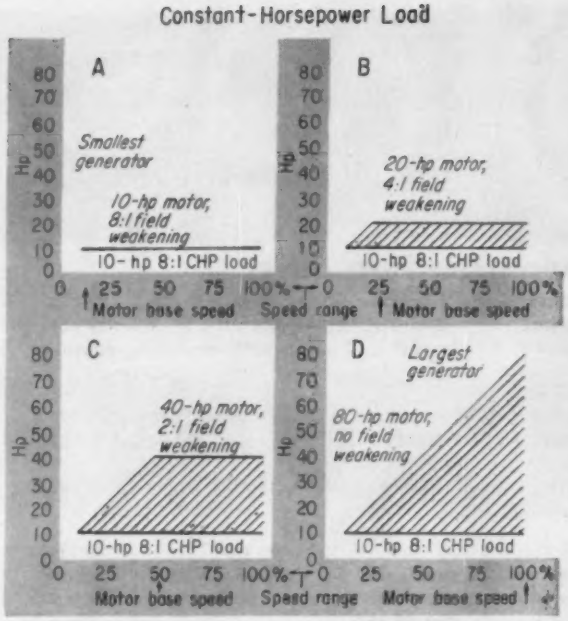


Fig 2—Generator size goes up as field range drops for a constant-horsepower load, 10 HP over an 8:1 range. Generator at A is used to full capacity. For B, C, & D the generator must be large enough to supply volts for top speed and current for 20-, 40-, and 80-HP motors respectively

and at full load 100%. The slope of the line would be the same at all speeds, so that at ⅛ speed (while the speed change in RPM is still 5% *of top speed*) it becomes 40% of the RPM at one-eighth speed.

But consider the feed drive which might have 80% load at all times. At 80% load, it has already used up 4% of the 5% regulation. Hence, the variation form 80% load to 100% load would only involve a speed change from 101% to 100%.

Also, since the load seldom varies over the entire range from no load to full load, even a 5% regulator does a good job.

The most common method of compensating for increased load is to use the IR drop across a portion of the circuit between the motor and generator to provide a voltage signal. This signal is fed back into the generator field circuit to increase the generator voltage as the drop increases. The increased voltage at the motor compensates for the IR drop, providing essentially constant motor emf and speed.

The chart gives the steady-state regulation to be expected of standard drives. This can be improved for constant surface cutting speed or numerical control, at higher cost.

For instance, by providing a tachometer generator on the motor, a true speed reference can be obtained. This signal can be amplified and fed back into the generator field circuits to provide the necessary compensating increase in generator voltage. Depending on the type of tachometer generator used, regulation of less than 0.5% can be had.

Electronic and amplistat regulators are also used when high performance is required. Stabilized reference circuits and drift correctors can produce regulation to 0.1%.

If a really sophisticated drive is required, there are only three candidates—motor-generator, static-conversion, and high-performance electronic drives. The final choice would be customer preference, comparing rotating vs static conversion.

Control features

We have covered size, speed-torque characteristics, speed range, thermal capacity, and steady-state speed regulation. These are, of course, the primary features of adjustable-speed drives. However, there are other features, such as control possibilities, which might affect the drive selection. These are charted in the last two sections.

The problem of starting may be serious in many applications, but for the majority of machine tools it is not too important. As a rule, a machine tool starts unloaded except for machine friction, so starting duty is light. In some cases a soft start may be necessary to avoid shock to the machine, but this is unusual. Starting torques as given on the chart are usually adequate.

Either timed or current-limit acceleration is usually available. For the eddy-current coupling, excitation can be programmed to provide linear or logarithmic acceleration with time. The belt shifting mechanism on the mechanical transmission can be fitted with a motor drive to bring the drive to preset speed.

Current-limit acceleration provides maximum utilization of the capability of the drive. It is ordinarily used when high breakaway torques or rapid accelerations are required. By holding the current to a predetermined maximum value, the highest value of starting and accelerating torque can be applied to the driven machine without endangering the life of the drive unit.

On machines where changes in speed must be made in the shortest time, current-limit control could conceivably provide the most desirable characteristics.

Overload protection is standard, and short-circuit protection can generally be provided as a modification. For the metallic rectifier, the preset speed is, of course, only in the field-weakening range.

Dynamic braking is standard or available as a standard modification. Regenerative braking works with M-G sets. •

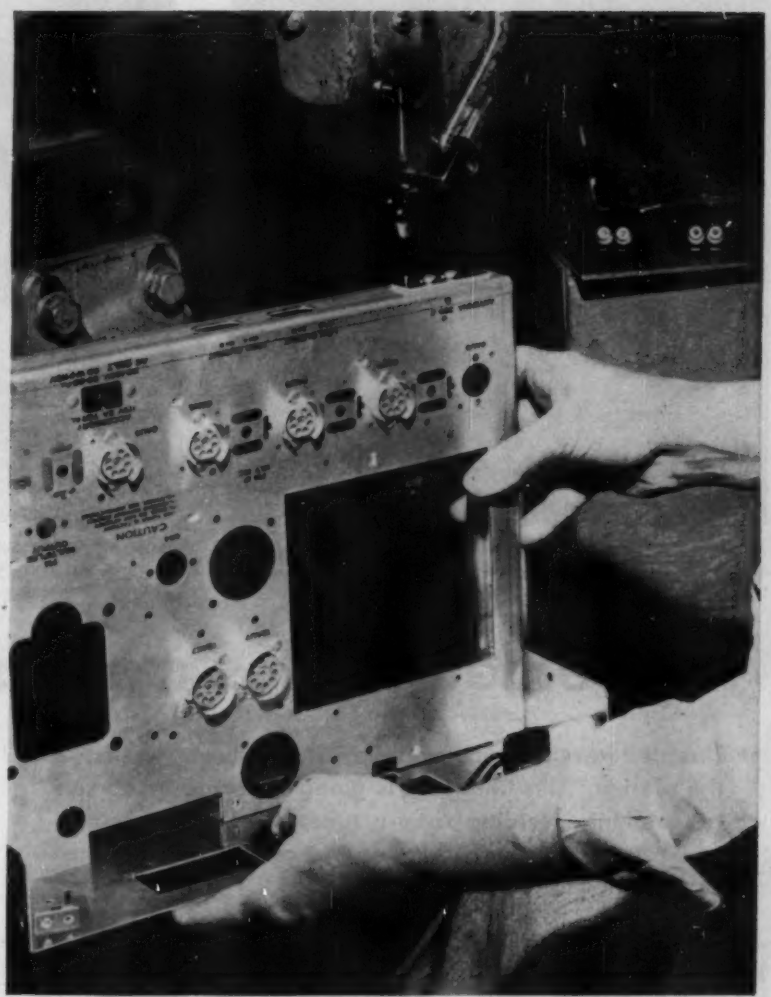
Elimination of large inventories of obsolete parts is one reason why...

Standardized rivets pay off

Changes in electronic equipment occur so rapidly that the manufacturer must either choose a versatile assembly method or be stuck with the added costs of small lot purchasing and a burdensome inventory of obsolete parts.

Versatility and standardization of assembly methods is one of the prime goals of the Tubular & Split Rivet Council, which cites as a prize example the seven-year-old program in effect at H H Scott Inc, Maynard, Mass, manufacturer of radio and hi-fi equipment.

Scott, which began by switching to tubular rivets and by leasing an automatic setting machine, now has eight such machines and consumes 300,000 rivets a month.



A phenolic terminal strip riveted to the chassis skirt required close dimensional tolerances when setting the rivet nearest the corner. Scott's riveting operations are performed without extensive fixturing. The operator orients the components on a spring-loaded guide pin in the anvil, then trips the machine. Rivet length is established on the basis of total thickness of the joint. Clinch is against the underside of the base in most cases

One type of rivet

Only one type of rivet is used by Scott—a ⅛ in. oval-head aluminum tubular rivet that is purchased in three lengths. Because length is the only changing dimension, rivet anvils are purchased in sets, each containing seven anvils differing in length by 1/32 in. If the rivet length needed is changed, the operator changes the anvil instead of adjusting the height of the anvil post. Prints are marked so he knows the anvil needed to rivet the assembly.

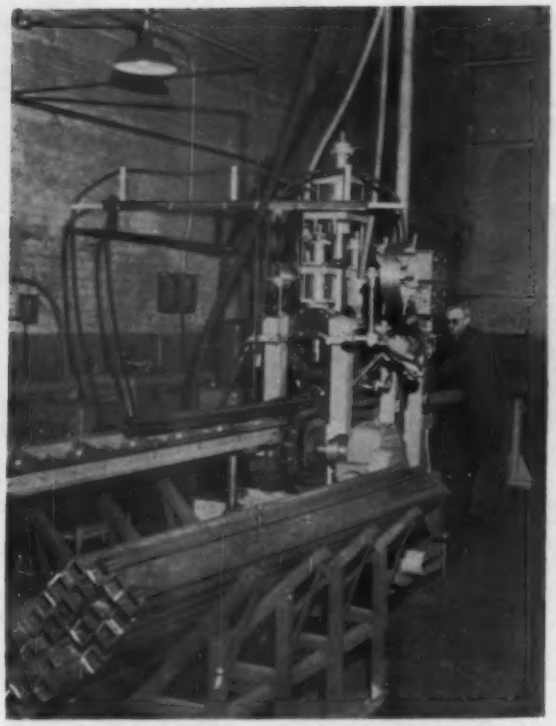
Because of the nature of its products, Scott prefers single-spindle mechanical riveting machines. The chassis often must be turned to various positions in order to rivet components to the side flange or to the skirt of the base, and this type of machine seems more suitable to the operation. Certain sockets, for example, attach to the chassis in any one of four positions depending on the function, and these applications favor the single-spindle models.

The eight riveters now in use are fitted with conventional automatic feeds mounted on the side of the frame. The same automatic rivet feed and raceway accommodates the three rivet lengths without having to make adjustments. There is no fixturing necessary to position the work under the driver. The operator merely places the parts to be attached over the guide pin in the anvil and cycles the machine.

Scott finds that in-place costs of rivets are low, and the fasteners are easily incorporated into new product models.

Indirect savings

Riveting has indirectly accounted for some production cost savings. Because the chassis for one of the company's turning units, as an example, can be formed in two sections and later riveted, there is less material waste in making the stampings. Costly material properties necessitated by the function of one of them may be omitted in the other when it isn't needed. Interferences during subsequent assembly operations, caused by close dimensional tolerances, are avoided by riveting the affected small parts to the sections before they, in turn, are riveted together. •



Angles pass two welding heads and become a square tube in automatic operation (except for part loading). Derail bar on run-out conveyor kicks completed tubes into rack

Parts move into automatic machine and are held in position on steel slat conveyor by rollers on scissors clamp. Operator removes round bar at end when angles are clamped

Welded angles make square tubes

Unable to get the type of drawn steel tubes it wants on the market, Allis-Chalmers is going in for do-it-yourself tubemaking—welding square tubes out of steel angles at a rate of 41 ipm. End result: low-cost, strong, easy-to-ship frames for farm machinery

By Ben C Brosheer, associate editor

If you can't buy it, you've GOT to make it. That's why Allis-Chalmers is making its own square tubes out of steel angles. Automatic cleaning and welding machines turn out the tubes at speeds up to 41 ipm.

These square tubes are replacing solid steel bars in some of the more rugged subassemblies for agricultural machines. Examples are the tool bars on tractors and the main frames for cultivators, planters, and seeders.

Lower weight, of course, is one of the main advantages. Shipping weights, for instance, are lower, and the farmer doesn't have to contend with such heavy equipment in the field. Costs, too, are reduced, but without sacrificing strength.

However, drawn steel tubes, in the sizes and wall thicknesses needed for this application, are not commercially available, except at high cost. Therefore, the Allis-Chalmers engineers designed a square tube that can be welded easily and economically from heavy-section steel angles.

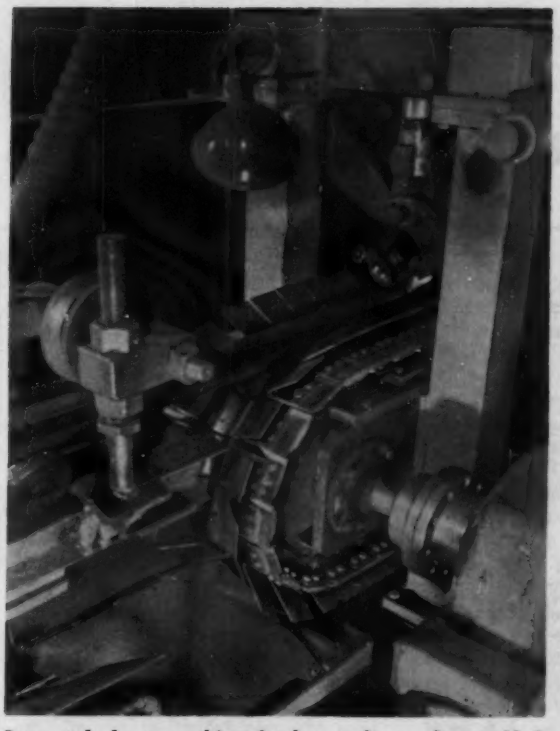
Specially rolled from AISI 1045 steel, the two angles that make up a given square tube are of different sizes, so the legs of one will fit inside the legs of the other. Tolerances on leg heights, leg thicknesses, and included angles conform with AISI standards, and the angles are machine straightened.

To weld the tube assemblies economically, Allis-Chalmers has installed at its La Crosse Works special shotblasting and submerged-arc-welding machines that deliver completed tubes 30 in. to 20 ft long at speeds up to 41 ipm.

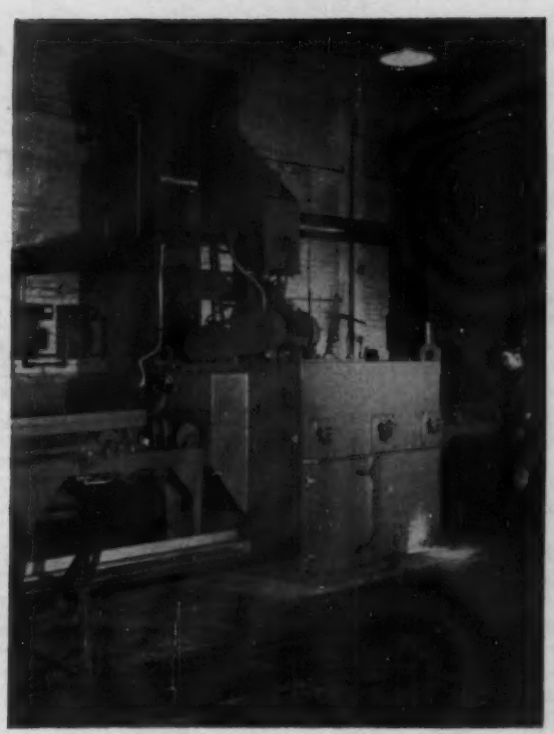
Prior to installation of the shotblasting unit, the angles were cleaned before welding by wire-brushing the joint surfaces. But wire-brushing was not enough; two welding passes were necessary—first, a rapid pass to burn out foreign matter and oxides, then a slow pass to insure a sound weld. Now the tubes are welded along both sides in a single pass with approximately 50% penetration at each joint.

How it's done

In normal operation, the operator first selects two angles of the correct length, one with larger legs and one with smaller legs. These he places on the roller conveyor at the feed end of the machine, with the larger of the angles lying on its back in the V-grooved rollers. Then he fits the smaller angle on top so that



Square tube leaves machine after being submerged-arc welded. V-shaped slats on conveyor support flux (Linde Grade 50) for welding, then dump it into chute for re-use



Special Wheelabrator shotblasting machine cleans hot-rolled steel angles better than wire-brushing; permits welding square tubes out of the angles in one pass instead of two

for lighter farm tools

the two pieces face each other and form an open square.

When this is done, he pushes them onto the powered steel-slat conveyor that takes them through the machine. As they advance, they pass a trip bar that closes a scissors-type clamp against the work, and, from this point on, the operation is automatic.

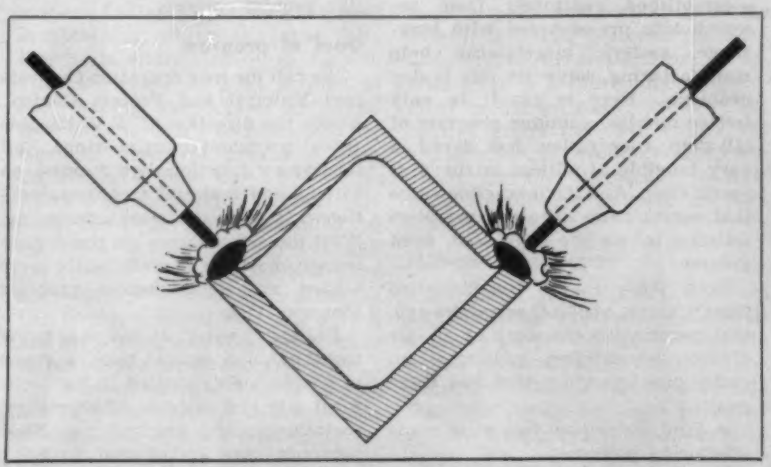
Welding the angles

The scissors clamp, a hydraulically operated device, presses its two idler rollers against the angles to center them and hold them down firmly in the V-slotted conveyor cross bars.

When the parts reach the two welding heads they pass the trip bars that start the welding operation and open the solenoid-controlled flux gates. Thus the machine welds only while the workpieces are passing under the heads. Simultaneous welding throws heat into both sides of the work, so the distortion is held to a minimum.

After passing the welders and a second scissors clamp, the tube feeds onto another grooved roller conveyor. A derail bar at the other end of this conveyor discharges the completed tubes into a storage rack that holds them until the job lots have been completed.

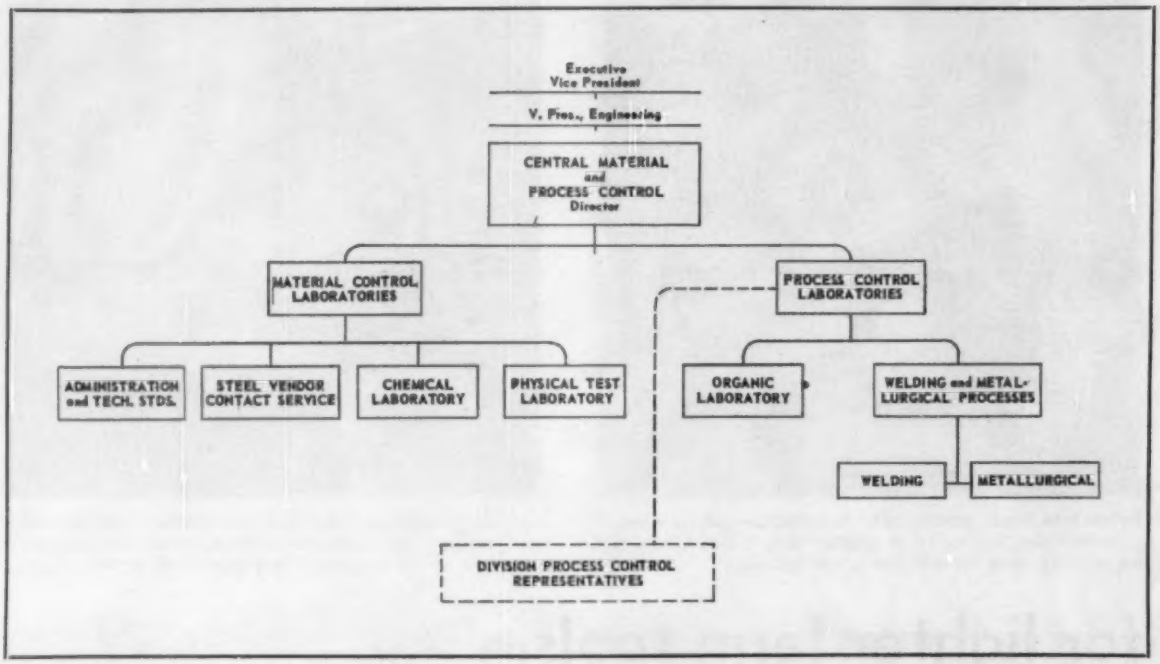
Developed through the combined efforts of the Works Maintenance Dept at the La Crosse Works and the Penn Tool & Machine Co of Danville, Ill, the special Berkeley submerged arc welder is equipped with two Linde DSH heads. Each head is connected to a Westinghouse 400/800-amp selenium welding rectifier. •



Simultaneous welds on opposite sides of assembly cause minimum distortion. Automatic machine produces sound welds with at least 50% penetration

Labs solve shop problems . . .

Centralized material and process



Organization chart shows how company has grouped its diverse laboratory facilities under one director. Any material or process problems that arise in the shop come to this group for solution. The group's work has saved company a substantial $1-million in only 12 months. These savings are re-invested in other material and process work

By F S Cornell, executive vice president, A O Smith Corp, Milwaukee, Wis

Chemical and physical laboratories —established separately from research labs pre-occupied with long-range, esoteric targets—can help manufacturing solve its day-to-day problems. Here is proof: In only twelve months, a unique program of lab-shop cooperation has saved a very tangible $1-million at the A O Smith Corp. And the intangible value that comes from keeping customers satisfied is, we are convinced, even greater.

Both these major benefits stem from a move, begun three years ago, that coordinated the work of all our diverse laboratories, putting them under one operation that has these goals:

- Find the critical factors in manufacturing processes
- Develop and apply effective material specifications
- Develop and apply really effective process controls

Goal of program

We call the new operation Centralized Material and Process Control. Under the direction of W W Higgins (vice president, engineering), all laboratory functions are focused on solving any material or process bottleneck that arises in manufacturing. With the setup shown on the organization chart, we can efficiently solve almost any technological problem that comes up.

Basically, what we did was bring together, in a central pool, a group of people highly skilled in the technical arts and sciences of chemistry, metallurgy, and engineering. Shop personnel are encouraged to bring any technical problems they have to this group for solution.

By focusing on the three goals listed above, we hoped to improve our manufacturing processes, as well as the application and usage of our materials. One main objective was to eliminate rejects. Another was to cut excess process costs—before they had a chance to occur. After some very human trials and errors, we have more than realized these early hopes.

Setting up the program

Our company's history has been no different from many another's. Over the years, we established one laboratory here, another there, as the need arose. All of them were very busy, pursuing their own goals and performing specialized functions. But three years ago, the increase in engineering and technological breakthroughs convinced us that we were entering a new era: New product designs would be more complex. Manufacturing processes would not

control *REALLY* pays off

only be faster, but would involve new, unheard-of materials. And there would have to be even greater emphasis on product quality. Our choice to meet these challenges: Centralized Material and Process Control.

Quick results

In the program's early days there were quite a few crossed fingers. Would the manufacturing groups want to take full advantage of laboratory facilities? How would production men feel about taking advice from "on the spot" technologists? These are questions that come up any time a new system, involving cooperation between the shop and an outside facility, is put into effect.

Actually, our fears were unfounded. One of the most pleasant surprises of the whole program has been the alacrity with which shop superintendents and foremen have grasped this new opportunity for help. Our technologists soon found themselves at grips with problems we did not really know existed. These were problems, it might be added, that shop personnel traditionally had wrestled with by rule of thumb or trial and error.

Today problems flow—with great regularity—into one end of Central Material and Process Control, and the solutions come rolling out the other end. I don't mean to infer here that we no longer have any unsolved problems, because we **just wouldn't** be human if we did not. But by now there is enough evidence to show that we have developed an extremely valuable management tool.

Three case histories

There will be no attempt here to go into the nuts and bolts of daily operations. But the accompanying organization chart shows the basic setup, and the following case studies illustrate the important role that Central Material and Process Control plays in our operations:

• *The first case study showed a direct saving. There was also a secondary tangible benefit and an unexpected intangible one.*

For many years we had disposed of metal pickle liquor in a sump at the rear of our property. Central Material and Process Control developed a chemical method of disposing of this pickle liquor. Besides the direct saving of money, we gained valuable yard storage space because we could fill in the sump. And our community relations improved, because the sump was at times odorous and unsightly.

• *The second case history is not quite so spectacular. But on the other hand it is very typical of the problems we have in day-to-day manufacturing operations:*

In a zinc-plating operation, which had a long record for running smoothly, trouble suddenly developed. Spots, with no plating at all, began to show up.

Here is a perfect example of how effective the new control system can be. Without it, the shop (which was unable to pinpoint the exact cause for the spots that appeared) might have had to suspend the plating operation far longer than necessary.

At once Central Material and Process Control began an investigation. Every factor involved in the operation was methodically studied: the properties and surface of the steel, pickling, forming, flash welding, machining, machine tools, the cleaning bath, and the plating operation itself.

Laboratory tests showed that a suspected sulphurized lubricant, used in machining, was not the cause. Further tests eliminated other factors, until the finger of guilt pointed at the cleaning bath. Then additional tests showed that a rosin soap in the cleaning materials interfered with the plating action.

But why the sudden trouble? Finally the vendor was consulted, to see if he had in any way changed his product. He had. He had used a new source of rosin soap. Elimination of this soap solved the problem, and the plating operation returned to its previous high standard.

• *The third case history shows how a whole chain of developments was touched off by a welding problem which came up recently:*

Cracking suddenly developed on a seam-welding operation. The cause might have been due to any of several factors: the size and type of weldrod, location and width of seams, temperature of the steel, humidity of the electrodes, amperage variation, or location and width of weld passes.

Taking up the case, the process experts assigned personnel to take data on each weld. Personnel from quality control assisted by testing each weld with the magnetic-flux method. Engineering got into the act by analyzing the data. Our welding research laboratory was called in to work on the problem.

From all this work came a first recommendation, which called for a certain preheat procedure. Subsequently, a new recommendation eliminated the preheat, but placed limitations on the weld bead. Finally, the welding research laboratory developed a new electrode that not only eliminated the restrictions on the weld bead but also completely licked the whole problem.

Acceptance of program

By now, Central Material and Process Control has been able to supply many of the trained people necessary to carry the program down through all the divisions of the corporation. These trained personnel, having come from the central group, tend to turn back to it for assistance when they have problems. They also tend to promote acceptance of the overall corporate material specifications that the central unit has set up. And there is a third important element in the program's success: The central group not only enjoys the extremely close coordination of manufacturing, but operates as a team with engineering as well as purchasing.

Million-dollar payoff

As stated at the outset, nearly a million dollars can be pinpointed as a direct payoff during a 12-month period from Central Material and Process Control. I might also add that this money has been promptly plowed back into additional developments of materials and processes, so that we can further improve our products and their quality. •

How well will your PATENTS stand up in court?

By Albert Woodruff Gray

Everyone knows the purpose of a patent. Not so well known are court decisions on the rights of a patent owner. Here are descriptions of several tricky cases involving patent infringement—and the decisions that the courts made.

Some time ago a manufacturer of tractors, who had patented (and was almost ready to market) a new machine, discovered that a competitor was already selling a very similar machine. Charging patent infringement, he brought action against the competitor. Let's see what happened in this case.

In court, the tractor maker noted that he had previously announced his patented tractor as "soon to be placed in production for sale." Arguing against this point, the defense claimed that, because the machine in question *had not been offered for sale*, the charge of infringement could not be sustained. Furthermore, the defense contended, no grounds for the action had been stated, because no charge had been made that anyone had actually used the infringing tractor.

Apropos of this case, the patent statute has this to say: "Every patent shall contain a short title of the invention and the grant to the patentee, his heirs, or assigns for a term of seventeen years, of the right to exclude others from making, using, or selling the invention throughout the United States."

Court's decision

Here is the Federal court's decision: "We cannot go with this argument of the alleged infringer, as it seems to have its basis in an erroneous assumption that 'use' of the article is a necessary element of a charge of infringement. If the [defendant's] tractor had infringed the patents, the manufacture of one machine would have made the manufacturer subject to a suit of infringement regardless of use." (1)

As its authority in this ruling, the court referred to a statement (about this feature of the patent law) made in the early years of this century. In this decision, the controversy was over patent infringement of sales books for use by retail-store employees.

"It is contended that there was no infringement because there was no sale and no use of the infringing article. The law gives to the patentee, for a period of years, the right to make and sell the patented article for which the patent was granted, and therefore a person who makes an article, the exclusive right to make the same having been granted to another, becomes an infringer." (2)

This rule was epitomized years later by a Federal court: "Proof of a single sale may be sufficient to establish infringement." (3)

Sales to government

Only a few months ago, before a Federal appellate court in California, a similar charge was brought—for the infringement of an electrical signal amplifier. Here the defense was that all but one of these infringing instruments had been sold to the Federal Government, thus restricting all but one of these sales to an action against the United States (provided by the patent law). Defense also offered the supplemental suggestion that non-governmental sales were not substantial enough to establish the accused manufacturer as an infringer.

"By the grant of a valid patent," said that court (sustaining the charge of infringement), "the owner obtains an exclusive right not only to prevent use by another of his invention, but likewise the making or the sale of the article. . . . Just as the manufacture of one machine by an infringer is sufficient to make the manufacturer liable regardless of use or sale, so one sale is sufficient.

"The mere manufacture of a patented article without sale is sufficient to create an infringement. And even the threat to use patented subject matter may give a right to a cause of action." (4)

Place for civil action

In another instance action was brought for patent infringement—this time over electrical apparatus. The main branch of the infringing company was in St. Louis, and branch plants were in Newark, NJ, Long Island City, NY, and Hartford, Conn. This suit, interestingly enough, came up in New York City, where the company employed only two men.

Here's what the patent statute says about the place for civil action: "Any civil action for patent infringement may be brought in the judicial district where the defendant resides or where the defendant has committed acts of infringement and has a regular and established place of business."

In support of an application to dismiss the action, defense argued that the company's New York City activities were merely "incidental to the filling of orders for goods manufactured in Missouri by expediting delivery thereof to purchasers along the Atlantic Seaboard."

The application of the infringer was denied. "A patent may be infringed," said the Federal court, "by manufacture, use, or sale." (5) Here sales had been made, and by the patent statute the action was properly brought in the district where

the sales had actually occurred.

It is important to note that the courts do not always, as a matter of course, grant injunctions against the continuation of infringing acts. In one case, an action (based on infringement of a railroad hand-brake patent) was brought against one of the larger Eastern railroads. Setting aside the injunction, the Federal appellate court had this comment to make:

"Where it appears that a much greater injury will be done to the infringer than a benefit to the patentee, the court may, within its equity power, grant an accounting only and deny injunctive relief. And where it is recognized that the only real advantage to the party in granting the injunction would be to strengthen its position in negotiating a settlement, the injunction should not issue." (6)

Thus in certain instances, courts are reluctant to grant injunctions against infringement when it is possible to avoid drastic remedy.

Change of product use

Can one company negate another company's patent by changing the end use of a patented product? In a typical case, the General Electric Co brought charges against another firm. The product involved was a high-potential switch (for opening and shutting off electric current) that had been designed to avoid the effects of oil carbonization. In court, the infringer protested that his switch (of the same design) had not been used for this purpose.

Here the defendant sought to justify his infringement by arguing that relatively noncarbonizable oil had been used in the application of his product. Too, he pointed out, the switch served a different purpose from that outlined in the patent. Of this argument that this special use of the switch fell outside the jurisdiction of the patent, the court had this to say:

"The patentee has the sole right to manufacture and sell its patented device, and no person can justify the manufacture and sale of this device merely because he intends to use it in some other way than that suggested by the patentee.

"The violation of the patentee's sole right to manufacture and sell can be justified neither by a special use nor by an entire non-use of the structure so manufactured." (7)

Licensing use of patents

Traditionally, the courts have upheld the sanctity of a patentee's monopoly, regardless of whether the object patented has been used for a special purpose not anticipated by the patent. In the field of licensing, the courts have held roughly the same attitude. But many charges of infringement have come up in cases that involved the licensing, *for a specific use only*, of a patented product. The following case is perhaps typical:

The holder of a patent on a vacuum-tube amplifier granted a license to a company for the manufacture of the amplifier. At the same time, use of the amplifier was restricted to sound recording and reproducing devices for the home or private field (reception of radio broadcasts, amateur reception, and radio experimental reception).

Fully aware that he was not supposed to make or sell these amplifiers for commercial or public use, the licensee nevertheless supplied them to a motion-picture company, knowing that they were intended for commercial use. The patent holder ordered an injunction, and when the litigation arising from the charges finally came before the United States Supreme Court, the ruling was as follows:

"Any use beyond the valid terms of a license is, of course, an infringement of a patent. . . . If, where a patented invention is applicable to different uses, the owner of the patent may legally restrict a licensee to a particular field and exclude him from others, this licensee was guilty of an infringement when it made the amplifiers and sold them to this purchaser. . . . And, because the purchaser ordered, purchased, and leased them knowing the facts, it also was an infringer.

"As the restriction was legal and the amplifiers were made and sold outside the scope of the license, the effect is precisely the same as if no license whatever had been granted to the licensee. And as the purchaser knew the facts it is in no better position than if it had manufactured the amplifiers itself without a license. It is liable because it has used the invention without a license to do so." (8)

The patent law provides that no one can make, use, or sell an invention without the patent holder's consent. But in some cases the courts have extended the patentee's exclusive rights even beyond these limits, punishing even the *threat* by another to pirate these exclusive rights.

Status of infringer

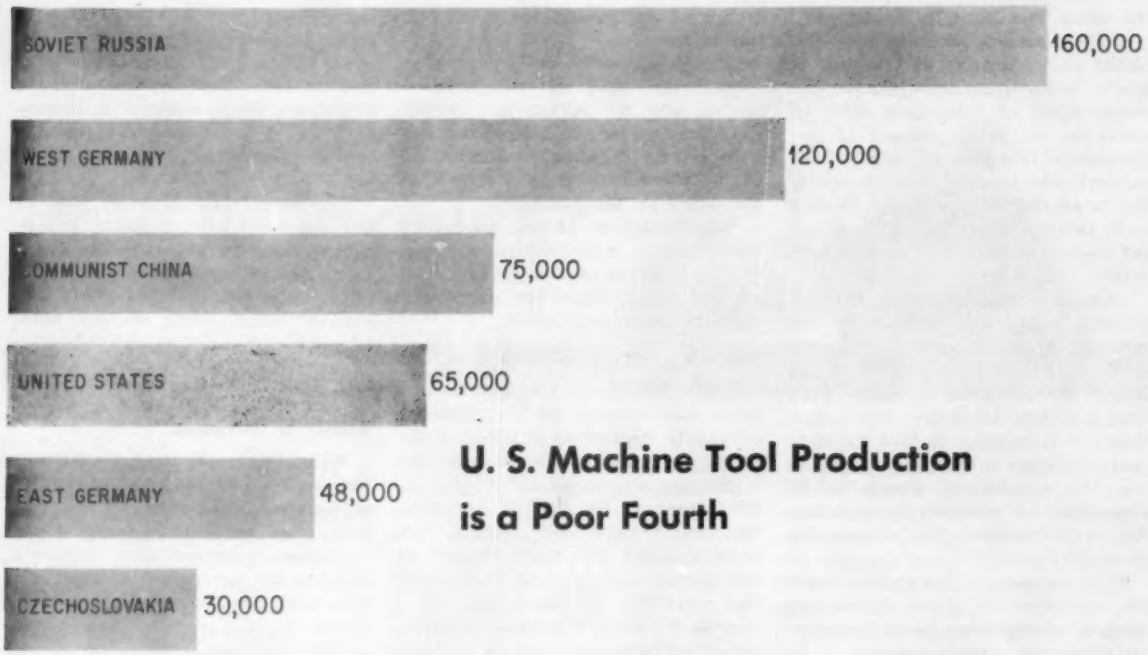
Many years ago, the United States Supreme Court outlined the status of a patent infringer, and gave the basic legal reasons for denying any exception to the exclusive monopoly granted by the patent statute, except with the consent of the patent owner.

"An infringer," said the Court, "does not, by paying damages for making and using a machine in infringement of a patent, acquire any right himself to the future use of the machine. On the contrary, he may, in addition to the payment of damages for past infringement, be restrained by injunction from further use, and, when the whole machine is an infringement of the patent, be ordered to deliver it up to be destroyed.

"No more does one who pays damages for selling a machine in infringement of a patent, acquire for himself or his vendee any right to use that machine. In the case of a license or a sale by the patentee, the rights of the licensee or the vendee arise out of contract with him. In the case of infringement, the liability of infringers arises out of their own wrongful invasion of these rights." (9) ●

REFERENCES

(1) Caterpillar Tractor Co vs International Harvester Co, *106 Fed 2d 769*
(2) Carter Crume Co vs American Sales Book Co, *124 Fed 903*
(3) B B Chemical Co vs Cataract Chemical Co, *25 F S 472*
(4) Neff Instrument Co vs Cohu Electronics, Inc, *269 2d 668*
(5) Federal Electric Products Co vs Frank Adam Electric Co, *100 F S 8*
(6) Nerney vs New York, N H & H Railway Co, *83 Fed 2d 409*
(7) General Electric Co vs Condit Electrical Mfg Co, *191 Fed 511*
(8) General Talking Pictures Corp vs Western Electric Co, *50 Sup Ct 116*
(9) Birdsell vs Shaliol, *112 U S 485*



U S trails Russia, Germany and China as machine tool producer

The United States has lost its leading position as a producer of machine tools and, based on numbers of units built, is trailing Soviet Russia, West Germany and even Communist China. It is, in fact, a poor fourth, according to the most recent survey of world machine tool production made by the European Committee for the Cooperation of the Machine Tool Industries.

In 1959, Russia built 160,000 machine tools, West Germany an estimated 120,000 and Communist China 75,000 (most of which are "still very rudimentary"). The American machine tool industry turned out 65,000 units. Even Japan manufactured 30,000 units in 1958 and somewhat more than that last year.

Only satisfaction that the U S machine tool industry might have is that, measured by value in Swiss francs, American output still is the biggest in the world. American production in 1959 added up to 2.8 billion Swiss francs, Soviet Russia 2.2 billion, West Germany 2.0 billion. Based on Swiss francs, U S builders manufactured 23.7% of the world production in 1959, members of the European Committee 38.1%, and the Eastern European bloc (Russia, Poland, Czechoslovakia, East Germany, Hungary) 30.3%. These figures show that the United States has slipped badly the past few years, for in 1956 American builders accounted for 43% of the world total (in value), comfortably surpassing the European Committee with 35% and being far ahead of the Eastern European bloc which had 20.5%

Other highlights of survey

- West Germany produces 40% of the machine tools (valued in Swiss francs) built in the nine countries belonging to the European Committee (Great Britain, France, Switzerland, Italy, West Germany, Austria, Belgium, Netherlands, Sweden).
- Metal-forming machine tools have been gaining at the expense of metal-cutting machine tools.
- Exports of machine tools from all countries belonging to the European Committee has risen from 38% in 1956 to 43% in 1959. Big gain in West German exports is mainly responsible, amounting to more than 1 billion Swiss francs. British exports meanwhile suffered a setback.
- Chinese machine tool industry has expanded at an astonishing rate, from 22,000 units in 1955 to 75,000 in 1959, but up to now its output is almost exclusively for the home market.
- Machine tool exports from European Committee nations to Latin America have increased from 102 million Swiss francs in 1955 to 206 million in 1959. In the same period exports to Asia went up from 114 million to 259 million. Gain in exports to North America was from 96 million to 160 million.
- Exports of U S machine tools, expressed in value, underwent quite a change. Shipments to European Committee countries declined from 48% of total U S exports in 1955 to 32% in 1959. Similar downturn occurred in shipments to Canada, from 23% to 15%. But the proportion going to Latin America went up from 13% in 1955 to 28% in 1959, and the proportion to Asia from

only 8% to 18%. U S machine tool exports to Brazil alone surged from 13.8 million Swiss francs in 1955 to 132 million in 1959.

• Soviet Russia exported 6000 machine tools last year, Czechoslovakia 20,000, and Poland 2000. Russian figures, however, do not include the machine tools exported as part of the supply of a plant on a "turn key" basis, or of complete industrial installations.

• Half the exports from European Committee countries go to other countries within the organization.

Machine tool exports

The Netherlands now exports a larger percentage of its machine tool production (in value) than any other nation, the European Committee's figures reveal. The ratio is about 76%. Switzerland is a close second with 74%, followed by Belgium with 73%. Czechoslavakia, which in 1955 led with 75%, now exports about 67% of its total production. West Germany exports about 50% of its output; the United States about 28% (up from 13% in 1955); Great Britain, 24% (down from 28% in 1955); and Russia now exports about 5% of its production (up from 1% in 1955).

Free World vs Communist

Not only the United States, but the nations of the entire free world have lost ground to the Communists in the past few years. In 1956 the nations of the free world produced 78.7% and the Communist nations 21.3% of the world total (in value). In 1959 the free world nations accounted for 66.9%, the Communist nations for 33.1%. •

Average Prices of Machine Tools Exported By Some Countries Belonging to European Committee

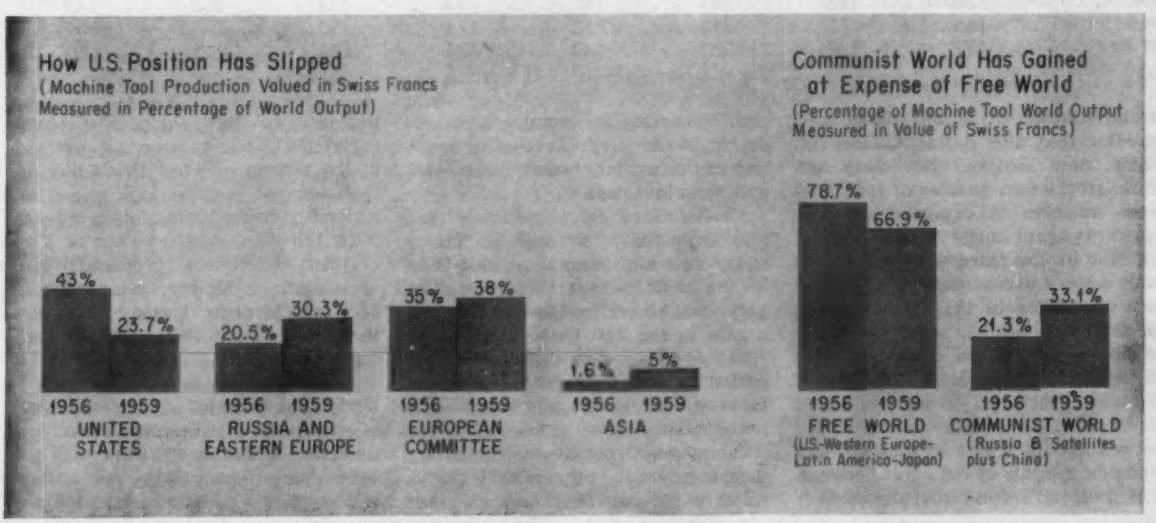
in Swiss Francs per Kilogram

Destinations	1955	1956	1957	1958	1959
Countries of the European Committee	7.05	8.05	8.35	8.40	8.15
Eastern Europe	8.65	11.75	10.20	11.10	10.90
U. S. A.	6.80	7.95	8.20	8.65	8.35
Brazil	8.55	8.05	7.60	8.40	10.20
India	5.80	6.50	7.40	9.20	8.90
Japan	10.40	11.25	10.90	9.35	11.40
Total exports	7.25	7.80	8.30	8.70	8.75

1 Swiss Franc = $0.2322; 1 kilogram = 2.205 lb; 1 Swiss Franc/kg = $0.105/lb

Where U S Machine Tools Have Been Exported

	1955	1956	1957	1958	1959
European Committee	48%	52%	42%	33%	32%
Europe — miscellaneous countries	2%	2%	3%	2%	2%
TOTAL EUROPE	50%	54%	45%	35%	34%
Africa	1%	1%	1%	1%	1%
Canada	23%	23%	20%	15%	15%
Latin America	13%	12%	15%	28%	28%
Asia	8%	6%	17%	18%	18%
Oceania	5%	4%	2%	3%	3%



Foundry "squeeze play" aids sand molding

"Sand flows almost like molten metal" is the report on a new foundry molding process developed by Taccone Corp, North East, Pa. Taccone has a hydra-pneumatic molding machine (right) which has a hydraulically driven ram with a central air chamber covered with a rubber diaphragm for squeezing sand into flasks automatically in high-rate repetitive casting applications.

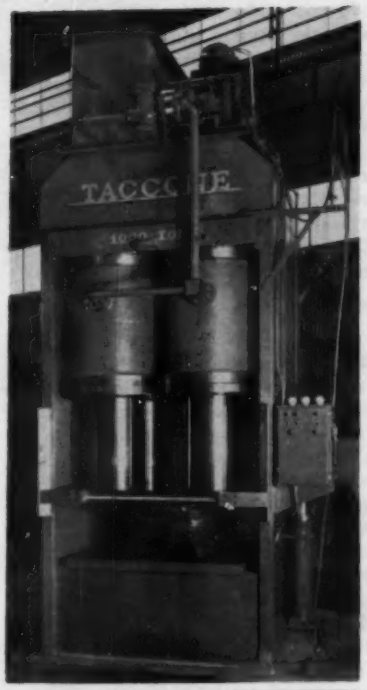
The advantages

The compensating diaphragm speeds up sand flow, fills deep crevices in the pattern, yielding harder, closer-tolerance molds.

Advantages of the Taccone method:

- Less bonding material is required.
- Less sea coal (an additive for improving homogeneity) is needed.
- Castings require less finishing.
- Moisture control of sand is less important. One firm which has researched high-speed automatic casting claims moisture content cannot exceed 0.1%, whereas Taccone claims moisture content is nowhere near that critical in its process—can in fact range from 2.5% to 5% without ill effects.
- A wider variety of sands may be used. Taccone has used sand samples from such differing foundry processes as gray iron, bronze, and steel to bear out this point.
- Cleaning costs are less.
- Castings, as they come from the flask, are to closer tolerances.
- Patterns can be set closer to the flask wall (because the sand is compacted harder and will find small interstices), and more pieces per flask can be made on each pour.
- Flask interiors can be smooth instead of dimpled and are thus easier to clean.
- Less scrap results from harder, more dimensionally stable patterns.

Foundrymen who have seen the new development at work are in agreement that it represents a major step forward for the casting industry. And the automobile industry concurs. Reportedly, one big automaker has already ordered a full line of the new machines, and others are interested. •



Metalworking machinery orders to rise in 1961

	Total Machinery							
1960	Seasonally adjusted	Unadjusted	Pumps & compressors	Engines & turbines	Construction & mining mach.	Metalworking machinery	Office machinery	Other Ind. machinery
I Q	169	177	327	161	193	168	220	154
II Q	180	184	321	180	197	175	227	161
III Q	176	168	297	138	161	176	215	150
IV Q*	168	163	265	146	162	183	192	145
1961								
I Q*	156	163	244	140	174	183	203	145
II Q*	166	170	258	158	174	193	210	149
III Q*	177	169	252	149	175	186	212	150

*Forecast made in mid-October, 1960. (1950 = 100)

Manufacturers of capital goods now predict that the dollar volume of their new orders will drop off through the first quarter of 1961. But new business is expected to turn upwards again in the second quarter, so that by the third quarter of 1961 new orders will be coming in at the same level as in the third quarter of this year.

According to the quarterly McGraw-Hill Machinery New Orders Forecast there will be a dip of about 11% in bookings of new orders between the third quarter of 1960 and the first quarter of 1961. But between the first and second quarters of next year, incoming business is now expected to rebound 6%, with an equal rise anticipated between the second and third quarters.

New orders for machinery are now expected to average 5% lower in the first nine months of 1961 than in the same period this year. **The only machinery group forecasting a gain in the first three quarters of 1961 compared with the comparable period in 1960 is metalworking machinery, where a gain of 8% is anticipated.**

Pump and compressor manufacturers expect the biggest drop (20%) in this period. They expect their business to fall sharply through early 1961, but foresee an upturn in the second quarter. Producers of turbines and engines look ahead to a steadily rising level of new orders, with the third quarter gain of 8%.

Office machinery producers are anticipating a slowly rising volume of new orders next year. However, they now expect 1961 third quarter business will be 1% lower than in the comparable period this year.

Manufacturers of general and special-purpose machinery—"other industrial machinery"—anticipate a very modest decline in new orders followed by a pickup in mid-1961. •

THIS METALWORKING WORLD

Japan—

Metalworking's sun is rising

Five years ago, Japan topped its prewar production levels. Today, spurred on by a phenomenal rise in living standards, Japanese Metalworking is hard put to cope with a flood of domestic orders for appliances, autos and other consumer goods. And demand for made-in-Japan cameras, transistor radios and sewing machines is fast rising in the West. This is the fifth in a series of on-the-spot reports from metalworking capitals of the world.

By Sol Sanders AM/MM Tokyo corespondent

Tradition and progress are constantly clashing in present-day Japan. Perhaps nothing illustrates this better than the sight of a Japanese housewife, clad in the traditional kimono and obi, preparing the family dinner on a brand-new, made-in-Japan electric rice cooker—or, conversely, a Japanese family in Western-style dress warming itself over a hibachi, the charcoal burner that has for centuries served as social center, heating system, and cookstove.

Japanese standards of living and mode of life are changing rapidly, moving closer to those enjoyed by Western industrial nations. The machinery needed for this changeover has created a record boom in Metalworking, with the result that Japan's industrial complex is now fifth largest in the world.

Progress has been startling

Machinery production today is nearly five times what it was just five years ago, and Metalworking is pacing general expansion.

Signs of a boom are everywhere—not only is production up, but the machine tool industry, for example, reports at least a year's backlog. Profits are up, too, with metalworking firms nosing out Japan's traditional big moneymakers, textile firms, for top place in the country's corporate profit reports.

This is only the beginning. Japan's Economic Planning Agency estimates that production of general machinery alone will jump 5.4 times by 1970; and electrical machinery, automobile and ship output will triple in the next decade. Radio and TV set production will just about double.

Some of this optimism, at least, is a reflection of the Ikeda government's political promise to double national income over the next 10 years—and the pattern of Japanese development in the last decade certainly puts this target into the realm of possibility. For the Japanese have not only rebuilt their prewar industrial empire, they have set a pattern of earnings and invesestment that more than equals any in the Western world, and even matches the extravagant claims of Communist nations.

The changing pattern of Japanese life is undoubtedly the prime reason for the metalworking boom. Foreign residents in Japan in the last three or four years have watched bugeyed as more and more Japanese homes installed TV, replaced hibachis with electric heaters. Not only that, Japan today for the first time has a small but growing number of automobile owners.

The pace of this move toward higher living is accelerating. In 1957, for example, appliance output was valued at $387.5 million. This year it will hit $720 million. In fact, it is estimated that about half of all Japanese metalworking is directly engaged in the appliance boom.

And while a significant portion of appliance output is going for export (transistor radios, for example), the bulk goes into the domestic market.

It is almost impossible to exaggerate the changes that are taking place in Japanese life. Probably no society in the world, not even those of the newly independent countries of Southeast Asia and Africa, is changing so rapidly.

The changing face of Japan

Apartment houses are springing up in the rice fields abutting the large cities . . . More than 5-million households now have TV sets, and 72% of the population has access to a set . . . Washing machine sales are booming, yet the man who introduced them five years ago got the horselaugh from other manufacturers because they thought the machines just couldn't sell in a country with a huge labor surplus and where domestic help is cheap . . . Just over 500,000 refrigerators were produced last year, and 750,000 will be sold this year in a country where they have been virtually unknown.

Paralleling this amazing consumer goods expansion is a tremendous growth in plant and equipment. The investment boom is only slightly less responsible than the appliance boom for the prosperity of Japan's metalworking industry. Capital expansion is increasing at a rate of about 20% a year.

The machinery industry benefited

directly and indirectly from this huge investment program. For instance: In 1959, metalworking industries (including shipbuilding) plowed back about $800 million into expansion and replacement. Because Japan is such a heavy importer of raw materials, its industry is perhaps more sensitive to investment than that in countries where a larger share of industrial activity is devoted to production of raw materials. By way of clarification, in 1959 about one-half of all Japanese industrial production fell into the metalworking category. Thus expansion programs called heavily upon new machines.

Last year, Japan regained her prewar place in world trade. That is, she once again was responsible for 3% of world exports. This was the last milestone in rebuilding Japan after World War II. Actually, Japanese exports surpassed prewar levels in 1955, but at that time Western Europe had made an even faster comeback in world markets, so that Japan could not corner her former 3% of world exports.

Postwar Japan's exports are quite different from those of 1936-37, considered the normal prewar year. Then, about 10% of all exports were machinery products. Last year, the figure was closer to 20%.

Japanese radios, cameras, sewing machines, bicycles and machinery components have by now become commonplace in the West. Last year Japan sold more than $104 million worth of radios alone overseas, almost $52 million worth of sewing machines, and about $35 million worth of textile machinery.

Shipbuilding boom

Most spectacular growth record among Japanese metalworking industries has been chalked up by shipbuilding. Today, Japan is the world's No. 1 builder of ships (in gross tonnage). Shipbuilding represents about 12% of all Japanese exports, about one-half of all metalworking exports. And because each shipbuilder averages 137 subcontractors, who contribute about 34% of the total value of a launched ship, shipbuilding is a cornerstone of Japan's metalworking prosperity.

Japan has held to its high level of shipbuilding despite a surplus of tonnage (especially tankers) in the last three or four years. The reason lies in the tremendous success of a Transportation Ministry program launched in 1950 and which has succeeded in reducing manhours per gross ton from 145 in 1949 to 63.9 hours in 1960. This increase in productivity has given Japan an inside track on world shipbuilding orders.

One man controls flow operation of the entire new, highly automated and conveyorized (right) assembly plant of Tokyo Kogyo at Hiroshima City. This US-designed (by Giffels & Vallet) plant cost $8.3 million, can produce 20,000 three- and four-wheeled passenger cas and trucks a month—making its capacity the greatest of all Japanese automotive assembly plants

World War II-destroyed Japanese industry has been rebuilt to prewar levels since 1955, but expansion has not stopped there. Since 1950 the Japanese have been spending about $200 million a year on expansion of energy resources. Electrical capacity now stands at about 80-billion kwh: Almost 50-billion kwh of this has been added in the last decade. Consequently, power supply is no longer the major problem it was in the 50s.

Not until the last two years have automobiles, mainstay of metalworking in most Western nations, figured prominently in Japan's economy. This year, production will top 1959's just-under-300,000-cars figure by 50%, making Japan the world's No. 8 producer.

But this rapidly expanding auto market has produced its own problems. For instance, the Japanese domestic market is heavily protected by tariffs, to give Japan's high-cost producers a fighting chance against foreign competition. Passenger car import taxes range upward from 125% of FOB prices.

Yet this very protection puts Japanese cars out of reach of all but a few Japanese pocketbooks. At the moment, auto purchases are almost entirely limited to taxicab fleets and company cars. Owner-drivers are becoming more common, but they're still a novelty in a country where less than $100 a month is considered a good salary.

Japanese manufacturers have tried to settle their cost problem with an export drive, but success has been spotty and sporadic at best. Most foreign markets will not accept a fully assembled car, so the Japanese have been forced to set up assembly plants in Brazil, Mexico, and soon will build one in India.

Their big hope has been the American market, where a system of subsidies gives them sales outlets. But recently the U S compact cars have cut badly into prospects.

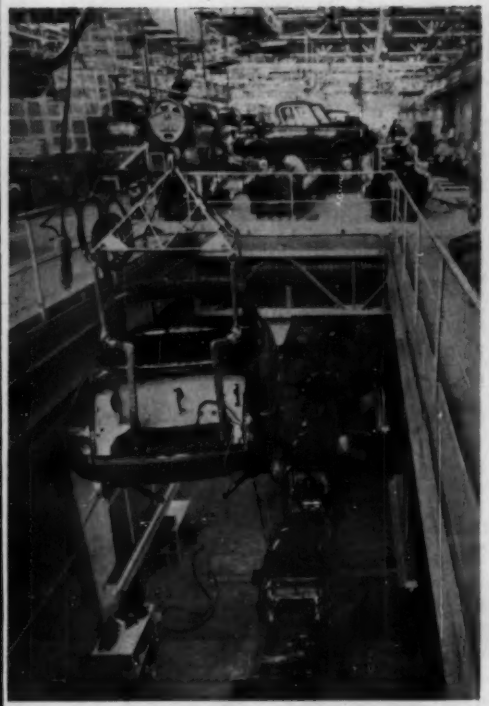
Even so, a domestic market for Japanese cars seems to be growing. In Tokyo, for example, almost 4000 cars were sold this July alone.

Small industry is "big"

But the most peculiar feature of Japan's metalworking boom, at least to Western eyes, is the role of small industry. If company operations with less than 300 workers can be considered "small," Japanese firms in this category are now turning out something like 65% of the national product, and they employ about 80% of the labor force.

They produce, exclusive of components for the larger companies, between 60% and 65% of total exports. It can well be argued that small industry is the sustaining force in Japan's economy.

But now a quiet revolution is sweeping small industry. Somehow, someplace—and no one who has seen the small Japanese family workshop quite knows how—these little operations are building up their tech-



nology and are investing in small machinery.

In the last few years, they have raised their technical standards so rapidly that the government standards agency has constantly had to revise standards upward. Now, the government is providing cooperative reserach and development facilities for those little firms that cannot finance their own.

These small enterprises have continued to exist simply because of the peculiar nature of the Japanese labor market. Already jammed to the bursting point with 93-million people, and with the great "baby boom" of World War II just hitting the labor market, Japan provides a classic example of Asian overpopulation.

For this reason, small manufacturers substitute cheap labor for the investment capital they can't get in Japan's high-interest money market.

The Japanese is prone to stay put. People from small towns tend to stay in small towns, city people in the city. The small town worker gets the short end on this—getting just about half the wage for doing the same job as a city worker.

Yet Western critics who accept at face value the charge that all Japanese workers are "sweated" is wrong. Japanese wages are rising, so is worker purchasing power and, because of post-Korean price stability, it is doing so at a faster rate than in the West.

In June, 1960, the Labor Ministry pegged the average monthly wage at a little over $50, plus about another 10% for biennial bonuses and other benefits. Metalworking industries pay a higher wage (about $60 a month plus benefits) on the average, and shipbuilding the highest of all—around $63 a month.

This may seem terribly low by Western standards, but wages have gone up an average 20% in the last five years, and increases over the last decade have averaged 6% to 7% a year.

Trained technician shortage

Japan does have a worker shortage in some sectors of the economy—trained electronic workers, for example. Last spring, university students and graduates with technical training had no trouble finding a job. As a matter of fact, the interviewing pattern (with due allowance for Japan's lower wages) is remarkably similar to U S firms' quest for engineering talent.

Japan has its trade unions, but they are a far cry from those in the United States and Western European countries. The trade movement is split into two widely different wings, one grouped under the leftist SOHYO banner, which seeks to improve the workers' lot by political action, and one grouped under ZENRO, a more orthodox setup patterned after those in the U S and Britain.

But the great mass of small-factory labor is not organized, and the unions can claim only a third of Japan's 23-million workforce. Too, most unions are organized on a company-wide, rather than on an industry, basis. They therefore tend to place the interests of the company before those of the industry as a whole—are in fact a sturdy prop for paternalism.

Dependence on world trade

Metalworking in Japan has a bright future, but much of its success will depend upon international developments, to which Japan is more susceptible than most nations. For instance, exports represent 9% of the gross national product, but they must finance importation of 40% of all industrial raw materials, along with nearly 12% of the nation's food supply.

Japan is not doing as well in world export markets as might be expected because, contrary to popular belief, she is by and large a high-cost producer. Her capital goods exports, for example, are priced at 10% to 15% above similar Western European products. This, coupled with an inability to sell the politically unsettled or Communist-dominated Eastern market, has thwarted Japan's attempts to become a major capital goods exporter.

For this reason, Japan is making increased capital goods exports a prime goal, believing that this is the only way to export her "labor," Japan's only abundant raw material.

Shipbuilding points the way toward the kind of improved technology that would make this possible. But even here the Japanes are not overly optimistic, because the present world shipping glut shows little sign of letup.

Consumer goods boom

We have been talking about capital goods, shipbuilding and heavy machinery exports. Consumer goods exports are a far different story. Cameras, transistor radios and the like all find a ready and still growing market among Western nations. In 1959, alone, for example, exports to the United States rose by 50%, and the same thing is true of Western Europe. Many of these products are made by Japan's small metalworking industries.

But consumer goods trade cannot forever remain one-way traffic. The Western nations would like to get a foot in the Japanese capital goods door with their lower prices, in return for providing a market for consumer goods. They would like to invest in Japanese firms, too, possibly even sell some consumer goods themselves in Japan.

Open door, or closed?

Japan is afraid of open competition from the West. Too long has its industry been geared to compromise between modern methods and cheap labor—operating somewhat like a wartime convoy in which the faster ships have to move at the speed of the slowest. In this case it is the reactionary, backward plant that retards the whole industrial economy.

The West, on the other hand, is bound by no such wait-for-the-slowest convention and with its greater industrial strength could very well swamp the relatively inefficient Japanese with goods if the trade door were to open wide. The only solution, and one which is being worked out by Japan after hot internal debates, is to open the door gradually.•

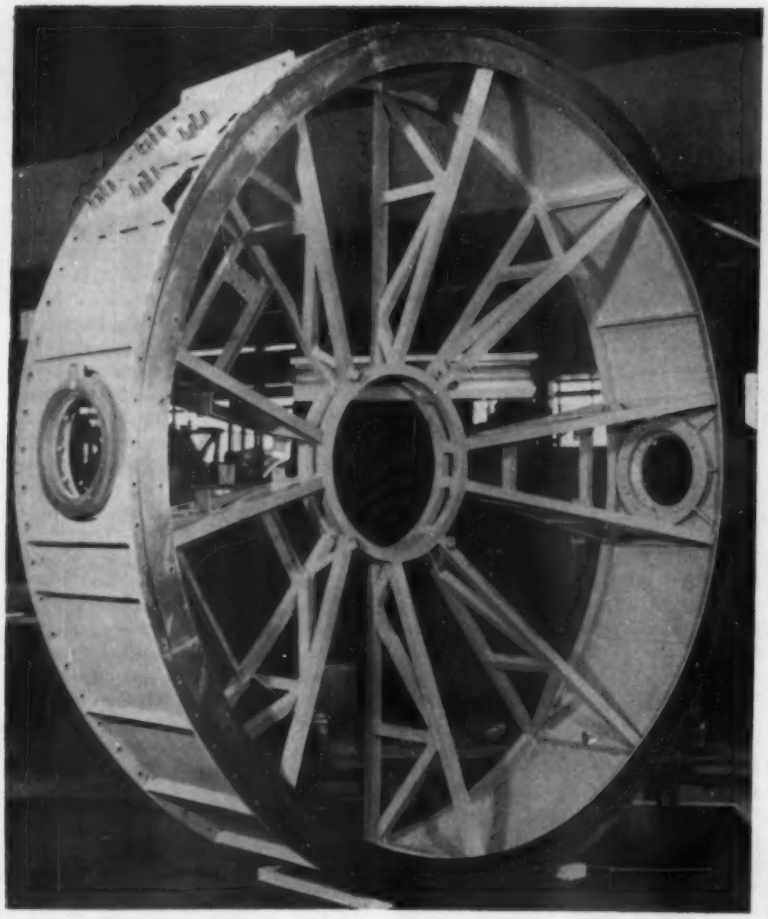


Fig. 1—Trunnion support castings must be bolted on opposite sides of the 8-ft dia weldment within parallelism of 0.002 in. Such close tolerances are required in Sperry's radar for guidance of the Terrier ship-to-air missile

Optical

Aligning trunnion-support castings for an 8-ft-diameter weldment was an inaccurate, cumbersome and time-consuming job with mechanical methods. Now, optical tooling does the job in a quarter of the time—aligning the castings concentric, parallel, and square to the centerline within thousandths

By Ernest Ruland, product engineer
Daystrom Military Electronics Division
Archbald, Pa

There are some alignment jobs that just can't be done efficiently by mechanical methods, at least not without a minimum of accuracy and a maximum of frustration.

A case in point: mounting trunnion support castings on opposite sides of an 8-foot-diameter radar antenna weldment. Not only must the holes be exactly opposite (because the slightest misalignment within the antenna can throw off accurate location of a radar "pip"), but the support castings which fit into those holes must be concentric within 0.0025 in., parallel within 0.002 in., and square to the centerline of the bore within 0.001 in.

At Daystrom we found that trying to do such a job with mechanical tooling methods was something like trying to knock a picture frame together without a jig—you get one corner joined perfectly and the one diagonally opposite comes apart, get the two opposite corners joined and a third comes apart, etc.

Mechanical problems

The plain fact is that on a big, weighty job like this, the overall dimension between bores is far greater than ordinary mechanical fixturing can cope with. Optical tooling is the obvious answer, but we found that out the hard way, first trying to do the job mechanically.

For example (see Fig. 2, left), the weldment was placed on a large surface plate—positioned with one casting on the surface plate and the opposite casting 8 feet above the plate. A fixture similar to a height gage supported an indicator that determined the parallelism of the top casting with respect to the surface plate

tooling tackles a tough job

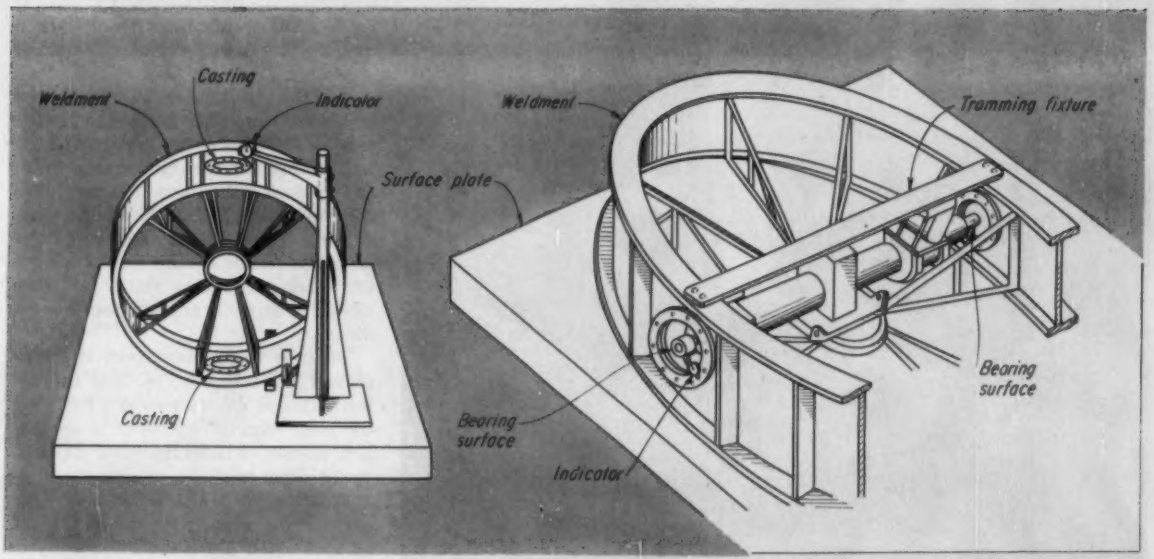


Fig. 2—Mechanical fixtures won't do for long-span precision measurements. Height-gage *A* is inaccurate; accumulation of errors in tramming fixture *B* made repeat readings impossible. These methods are the conventional approach

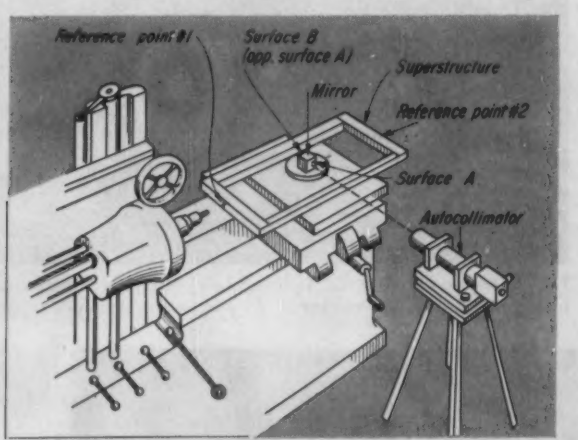


Fig. 3—Beginning of Accuracy. Optical tooling increases accuracy of indexing 20-fold, when boring reference points in an indexing fixture for the weldment. Reference points are held to 180° ±5 sec.

(and hence parallelism with the other trunnion-support casting).

To say such a setup is cumbersome and unreliable is putting it mildly. Not only is it difficult to move the large fixture over the surface plate without vibration, but deflection in the beam supporting the indicator also causes error.

Then we tried another mechanical method (Fig. 2, right), in which the weldment was laid flat on a surface plate and a tramming fixture was placed inside the weldment. The ends of the tramming fixture were accurately aligned bearing surfaces.

An indicator mounted on a collar was placed over the bearing surface, so that each trunnion support casting could be explored with the indicator to determine concentricity and run-out of faces.

Unavoidable deflection

It was essential that both bearing surfaces of the tramming fixture be on exactly the same centerline, but the fixture because of its size could not be made in one piece, and errors in assembling the various pieces accumulated. Deflection in the fixture proved another unavoidable source of error. Together, these problems made it almost impossible to get repeat readings. Not only that, the tramming fixture weighed several hundred pounds, and required a crane and two men to place it in the weldment—a job that had to be done many times over in adjusting and assembling the trunnion supports.

Obviously, these machining and positioning problems were a direct result of the size of the weldment. Any mechanical fixture built to span large distances is bound to have errors greater than 0.001 in. resulting from sag and deflection. The ac-

Fig. 4—Reference point No. 1 (bored hole) in fixture is picked up before boring and facing the seat in the weldment, to receive the trunnion support

curacy of optical tooling, on the other hand, is not affected by distance and is thus the best method for machining and inspecting a weldment of this size. We have found that optical tooling takes just about one-fourth as long to do the job as mechanical tooling.

For this particular operation, the weldment must be machined to the same tolerances as those required for positioning the trunnion supports, so as to avoid difficulties in assembling the supports to the weldment. Machining of the weldment was done on a horizontal boring machine with an index table that could be positioned to an accuracy of about 5 minutes.

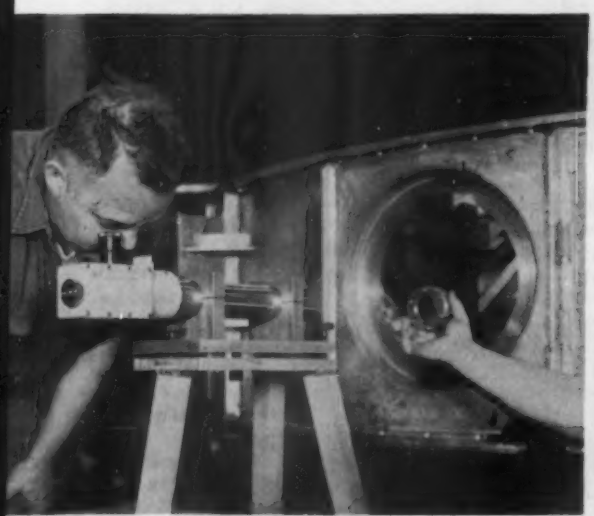
Because the diameter of the machined surface is 14 in. and the allowed linear displacement is 0.001 in., the total angular tolerance is the angle whose tangent is 0.001 divided by 14. This angle is 14 seconds.

Thus to keep the machined faces parallel to each other within 0.002 in. each face has to be indexed with an error of no more than 14 seconds —an accuracy 20 times greater than the boring machine is capable of providing.

A superstructure was built for mounting the weldment on the index table. With optical tooling, reference points (for indexing the table to required accuracy) were placed on each end of the superstructure.

Positioning index points

Fig. 3 shows the optical tooling setup necessary to position the index points in the superstructure. A double-sided precision mirror, the



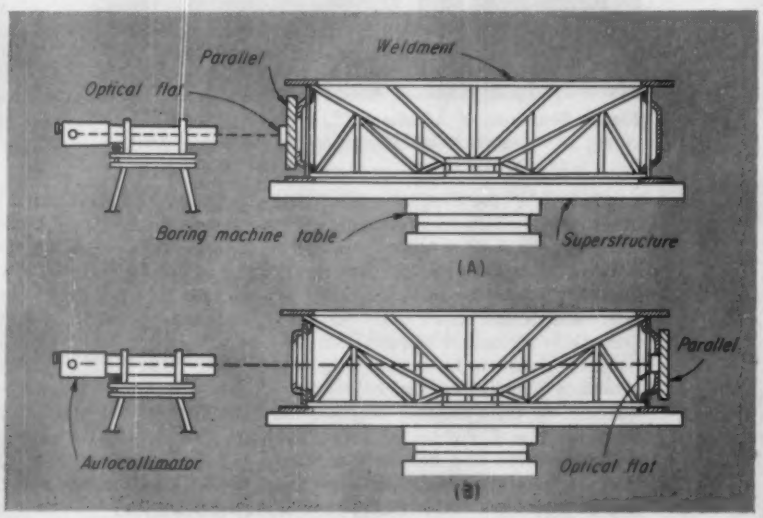


Fig. 5—Parallelism of the trunnion-seat is established by sighting a collimator on an optical flat and parallel, first at *A* and again at *B*. Reading at *B* is the angular error of the two machined surfaces of the weldment

sides of which are parallel to within a fraction of a second, is set in a convenient position on the superstructure. An auto-collimator is lined up with side *A* of the mirror and adjusted until it shows zero error. The zero reading indicates that the line of sight of the collimator is exactly at right angles to the mirror. When this has been done, reference point No. 1 is positioned on the superstructure.

The table is then rotated until surface *B* of the mirror is opposite the collimator. Because the mirror is made accurately parallel, the collimator will read zero again when the table is rotated exactly 180°. The table is adjusted back and forth until the collimator shows zero error and reference point No. 2 is positioned. Index reference points 1 and 2 are now 180° from each other, ±5 sec.

Permanent references

Once the points are positioned on the superstructure, they become permanent references. When a weldment is to be machined, the center of the weldment is positioned on the center of rotation of the index table and the spindle lined up with reference point No. 1, Fig 4. The operator then raises the spindle a preset amount and machines hole No. 1. The index table is then rotated until reference point No. 2 is accurately lined up with the spindle, and hole No. 2 is machined in the weldment. Both machined surfaces are now accurately positioned 180° apart.

Accuracy of the machined surfaces can be checked while the weldment is mounted on the boring machine. An accurately made parallel is placed across the face of the bore and an optical flat is placed on top of the parallel as shown at *A* in Fig. 5. A collimator is lined up with the flat and adjusted until it indicates zero error. With this setting of the collimator as a datum, the parallel and flat are moved to the opposite face and sight taken, as at *B* in Fig. 5 The collimator reading at the second sight is the angular error between the two faces.

Mounting trunnion supports

Each trunnion support consists of two castings with spherical surfaces, so as to make adjustments possible in any plane. Before the trunnion support is bolted to the weldment, surfaces 1*A* and 2*A*, Fig. 6, are assembled parallel to each other within 0.0002 in. Since the weldment is accurately machined, the trunnion supports should be close to the required tolerance when they are bolted to the weldment.

Measurements for making final adjustments to the trunnion supports are illustrated in Fig. 7. The weldment is placed flat side down on a 10 x 10 ft surface plate. An accurate reference with respect to the surface plate is established with a Davidson comparison autocollimator, a pentaprism and a reference mirror.

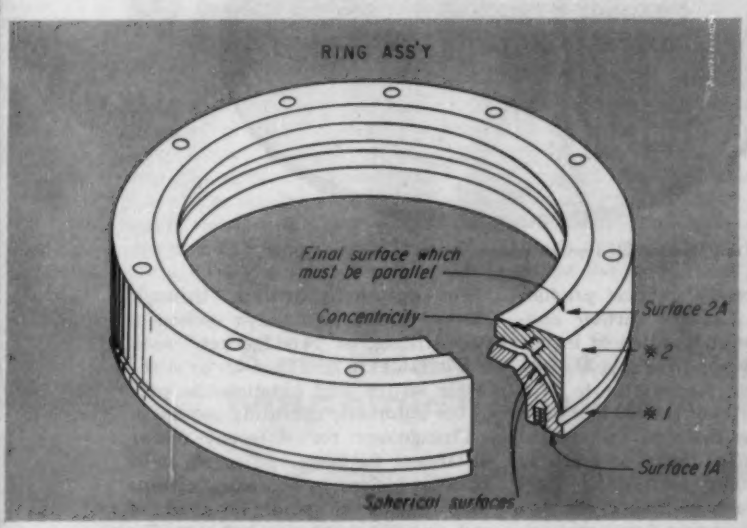
The comparison autocollimator is divided in such a way that one half establishes a reference with the surface plate and the other half views the object being measured. The half which establishes the reference looks into a pentaprism, which deflects the line of sight 90° to a mirror on the surface plate. The target reflected back from the mirror establishes a reference which is exactly at right angles to the surface plate.

The half of the autocollimator which views the object has a tipping plate which can be adjusted to bring the sighted target into alignment with the reference target. It looks directly into a mirror mounted on a parallel placed against the face of the trunnion support.

Images in each half of the autocollimator are compared and the difference measured by a micrometer dial which is coupled to the tipping plate. During the measurements, a change in position of the autocollimator moves the compared images in the field of view, but has no effect on the micrometer reading. Therefore, it is not necessary to mount the autocollimator rigidly.

The autocollimator reading establishes the vertical angle of the trunnion support with respect to the surface plate. The parallel and mirror are then placed against the face of the other trunnion support and a reading is taken with the autocollimator. Likewise, this reading also establishes the vertical angle of the trunnion support with respect to the surface plate. Because the angle of both trunnion supports with respect to the surface plate is known, the angle of both supports with respect to each other can be determined.

If the weldment were machined perfectly, no further alignment would be necessary. Because this is not possible, final adjustments must be made. While one operator sights the trunnion support through the au-



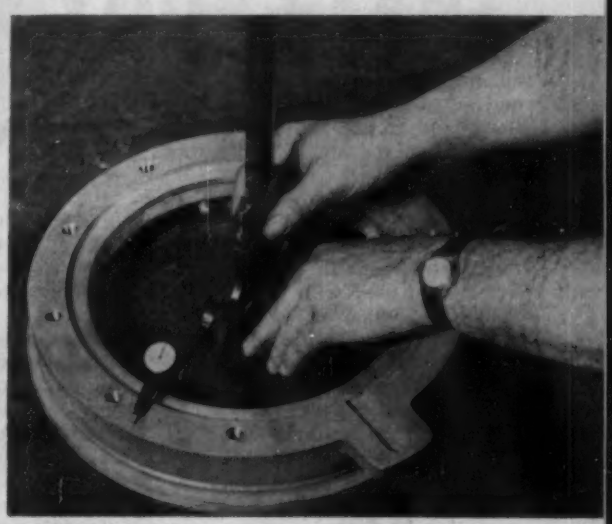


Fig. 6—Trunnion supports consist of two castings with spherical seats. The parts are assembled so that surfaces 1A and 2A are parallel within 0.0002 in., to minimize adjustment at final assembly of the trunnion

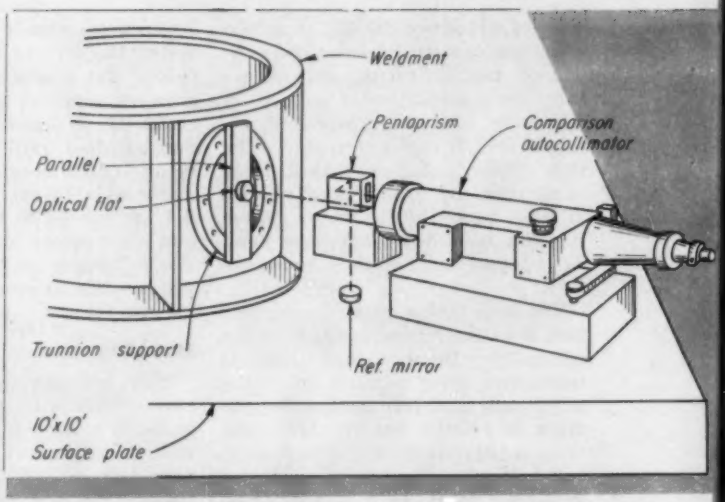


Fig. 7—Final adjustment of the trunnion supports is made with the aid of an autocollimator. This setup establishes the vertical angle of the trunnion support with respect to the surface plate

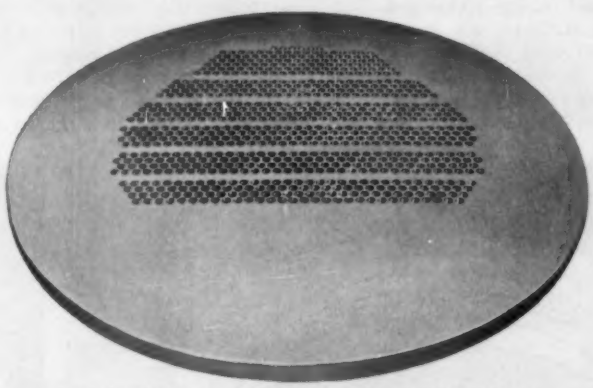
tocollimator, another operator loosens the bolts of the assembly and gently taps it until the autocollimator reads zero. A similar operation is performed on the opposite trunnion support and a final optical check made between the two supports.

The weldment is then turned upright on the surface plate and height gages used to make the axis of the bores parallel to the surface plate. A collimator, pentaprism and mirror are set up as before and the angle of each trunnion support with respect to the surface plate—and therefore with respect to each other—is determined. Necessary adjustments are made to correct the horizontal error and a final optical check is performed.

Optical tooling techniques for positioning the trunnion supports in the weldment can be applied to many other machining problems involving large distances. The optical tooling instruments can be used on many entirely different projects. •

Tape arranges spindles, positions work for drilling

Twenty-three drill spindles in a line permit line-at-a-time drilling of tube sheets, for boilers and condensers, on Moline Tool Company's Model HD68 multi-spindle tube sheet drilling machine. Each spindle is equipped with a power-actuated gagging device so that each, or any number, of them can be selected to drill or not drill when the machine rail is moved downward to feed the drills through the work. If necessary, two more spindles can be added, for a total of 25. (See cover)



Tube sheet drilled on automatic, multi-spindle machine

Controlled by tape

Spindle selection is an auxiliary function of the Multi-Numetric control system used with the machine. Table positioning, in two directions, is controlled by a General Electric Mark II Numerical Positioning Control modified for this application. The two table-positioning motions, together with the auxiliary spindle-selecting functions, permit drilling at any point within the 84-in.-square worktable area. If necessary, a bolt circle can be drilled.

Multiple spindles plus proper programming greatly reduce production time — a saving further augmented by the elimination of layout on the work prior to drilling. Manual positioning, for checking or to drill a few holes without punching a tape, is provided by dials on the control panel. Normally, the tape initiates spindle selection, positioning, start and stop of each drilling cycle, and automatic sequencing for each position.

For deep-hole drilling, through stacked sheets or a heavy section, a step-drilling, or "woodpecker," feed is available. It is turned on by a selector switch and functions as part of the automatic operating sequence.

Changeover for different center distances between adjacent drill spindles is done by loosening clamps which fasten the spindle heads to the rail, inserting spacers between the heads, and reclamping spindles. •

Within five years, it is estimated that metalworking production capacity will increase 20 to 33%. This same period will be a time of corporate mergers, of branching out to seek new markets, of geographic reshuffling of industry. The next decade, as never before, will see a scramble for new plant locations to meet demands of a changing metalworking complex. Here are the ground rules, based on the experience of hundreds of companies, to help you avoid pitfalls in determining . . .

WHERE TO LOCATE YOUR PLANT

By Maurice Fulton,
partner
The Fantus Co
Chicago—New York

Metalworking companies expect to increase production capacity anywhere from one-fifth to one-third over the next five years. Much of this will go into expansion of existing plants, but many firms will set up new plants in other areas to take advantage of lower labor and freight rates, to penetrate new market areas, or for any number of reasons. And many companies in the next few years will decide to relocate their operations completely.

The selection of a new plant location is not to be taken lightly. It is one of the most important decisions a firm is called upon to make, and the wisdom of a choice can influence a company's profit structure for years to come.

Yet far too many companies enter into such a move simply because they are entranced by the thought of paying lower prevailing wages in another area, or because they can buy land cheap, or a certain state offers all kinds of tax incentives to incoming industry.

American Machinist / *Metalworking Manufacturing*

Special Report No. 500 December 12, 1960

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WHERE TO LOCATE YOUR PLANT

Selection of a new location may arise for any several reasons, but probably the most important of these is the need for more space. A metalworking company is faced with this problem when it (1) needs more production area to reduce congestion, (2) is adding new equipment, (3) is adding new products to existing lines, or (4) has designed a more efficient layout and needs more space.

Shifting markets

Or a company may need to build new branch plants, or relocate its old plant, to keep pace with changes in the importance of its established markets. An outstanding example of this in recent years has been the shift of textile machinery makers from New England to the South, following the exodus of textile mills from the North.

The development of new markets can also influence location, as can introduction of a new product line, a new use for an old product, or the development of new customers for existing products.

Of all marketing considerations, probably the most significant is the shift in importance of various geographic sections of the country in so-far as industrial concentration. The growing importance of the West Coast, the decreasing importance of New England, and the decentralization of many plants into the South, have all affected marketing in the last decade. (See table opposite).

Competitive costs

Competition has prompted many firms to move to new locations. Here, labor cost differential is the chief motivating factor. In location studies we have made involving more than 1000 metalworking firms, we have found area wage differentials of as much as 75¢ to $1 an hour or more for given skilled or semi-skilled machine operator classifications. Area differentials, incidentally, tend to be far greater in the lower grades of skills. (See map on pages 124-125).

General freight increases have an adverse effect upon specialized mass production plants, widening the differential between short-haul delivery costs of a small-scale local competitor, and the long-haul rates applicable from larger plants in distant cities. Such increases have in many cases forced companies to establish regional production plants in order to maintain a dominant position in a given market area.

Customer service

When a company is the only supplier of a given product to an important industrial customer, that customer may switch to two independent sources, so as to forestall possible loss of supply through fire, strikes, and the like. Not only that, the customer may insist that a supplier move close to a new plant. Automotive parts suppliers, for example, have found it advantageous to decentralize along with the decentralization of auto assembly plants over the last decade.

Common denominators

Any location considered for a new plant must offer certain basic advantages, regardless of the geographic area in which it is situated. For example, all industry requires an adequate labor supply—in terms of quantity *and* quality. There must be a big enough labor pool in the area to allow *selective* staffing of the plant.

Then there are utilities to consider: Are water, power and fuel available in needed quantities on a reliable basis and at reasonable prices? Transportation services, too, must be suitable and flexible enough to prevent undue penalty of service or cost.

Terrain conditions must be conducive to preparation of a site without excessive costs. And, finally, the area must be oriented to raw material supply and to a company's markets.

The criteria are necessarily general, and every industry group will have its own requirements in addition to these.

Labor force

The importance of a labor force possessing at least some metalworking skills cannot be stressed to strongly. It would be economic suicide, for example, for a company to walk in cold into a low-wage area and expect to train tool and diemakers, setup men, machinists, or even machine operators capable of reading blueprints, from scratch.

Feeder services

A metalworking company moving into a new area would do well to investigate the availability of such complementary services as tool and die shops, mill supply houses, possibly a steel warehouse, transport firms specializing in the movement of steel and other metals, electric power sources and services capable of absorbing unusual welding loads, sewage systems capable of handling plating or pickling effluent; and rapid transportation between the new plant location (if it is a branch) and the home plant, where basic tools and dies can be made, maintained or repaired.

The importance of these special metalworking requirements, and of overall locational requirements, will of course vary from firm to firm. Obviously, a company's need for skilled machinists will be greater if the plant is operated on a job shop basis, where work is performed directly from blueprints, than it would be in a mass production shop, where jigs and fixtures permit simplified, repetitive operations.

Location planning

A new plant location must produce maximum profits by cutting down on production and distribution costs. It is rarely possible to achieve these goals without effectively planning the entire location or relocation process.

This planning must begin with an analysis of the company's reasons for such a move. Will it increase production? Will the new location cut production or distribution costs, or both? Will it service a new market the company cannot reach from existing facilities? Is obsolescence of existing facilities forcing constructon of a new plant regardless of location?

What to look for

No matter what the reasons for the move, certain definite steps must be taken in any intelligent location search:

- Space requirements: A site must be chosen with a view not only to immediate requirements, but to future expansion.
- Manning table: A precise list of needed manpower should be made, broken down by (1) job classifications, (2) time needed to train unskilled workers, (3) absolutely estransferees who might be moved to sential skills, and (4) the number of the new location, etc.

Percentage increase in manufacturing employment by regions 1947-1955

	Fabricated metal products	Chemicals	Textile mill products	Electrical machinery	Furniture
United States	+13%	+21%	–15%	+36%	+19%
New England	–12	+ 2	–43	+38	+22
Middle Atlantic	+11	+ 4	–27	+26	+18
East North Central	+ 8	+21	–24	+21	– 1
West North Central	+16	+26	–22	+35	+ 8
South Atlantic	+32	+16	+ 6	+99	+41
East South Central	+30	+47	– 9	+191	+25
West South Central	+70	+46	+15	+361	+76
Mountain	*	*	*	+230	*
Pacific	+53	+61	0	+263	+30

*Industry not represented in this region

• Utility requirements: Are water, power, gas and fuel adequate not only for initial stages of production but for anticipated expansion?

• Distribution pattern: A listing of important markets to be serviced by the new facility, and the relative importance of each.

• Existing vendor locations: These should be plotted along with alternative vendor possibilities closer to the new location. (It is erroneous to assume that existing sources of raw materials will have to relied upon at a new plant location.)

Weighing all factors

Once these and other criteria have been determined, their relative importance must be appraised. Which factors are critical, which desirable, which dispensable? From this appraisal, it will be discovered in a search for a new location that some degree of compromise may be necessary. For example, is it preferable to locate the plant farther from the source of raw materials, in favor of proximity to major markets? Is it better to move into an area with a higher prevailing wage rate, but which has an available skilled labor pool?

Such decisions will be many, and they must be made on the basis of which preferences are absolutely essential to the economic well-being of the company, and which are not.

As a final step in preplanning a location search, it is desirable to consult such departments as production, personnel, sales, purchasing, finance, and traffic. Frequently, the entire location project must be kept confidential. It is then up to management to decide whether the advice obtainable from the departments offsets probable broadcasting of company motives.

It is no news that labor costs vary widely from region to region, but many firms planning a new plant fail to realize that labor costs also vary widely among given communities in the same region. Furthermore, islands of low labor costs exist in broad areas of high cost, and the converse is also true.

Communities in high tax cost states may offer a low total tax burden because of attractive local conditions. A location in an industrial state, close to important markets, may be more isolated than a remote area, simply because of inadequate transportation facilities.

Differences in availability of skilled metalworking labor also vary greatly from region to region. As a rule, the supply of skilled workers tends to be smaller in areas in which labor savings are the greatest.

The low-wage areas usually have a prospective labor force made up of farmers, or people from services, trades, and industries that pay less than metalworking. Usually a training program is required in such areas, but if a company is willing to undertake a training program it will find a much greater supply of human material.

Regional tax variations

Regional differences in climate can be an important consideration in selecting a metalworking plant site. If outside storage of metal is involved, areas of low corrosion may prove attractive. And adverse weather conditions can produce excessive absenteeism among employees, and among the construction workers who build the plant.

Regional differences are also apparent in state tax structures. Some 33 states, for example, levy corporate income taxes, and several other states have franchise taxes very similar in coverage.

Apart from the taxes themselves, the way in which a state or local government administers those taxes is an important part of the region's business climate. For instance, changes in legislative or executive branch attitude toward business and industry can influence the ultimate success of a newly-moved-in manufacturing operation. Nineteen states now have Right to Work Laws, while 16 have Fair Employment Practice Laws, and three states have both. That means Right to Work *could* be adopted by 31 states, and FEPC by 34 states.

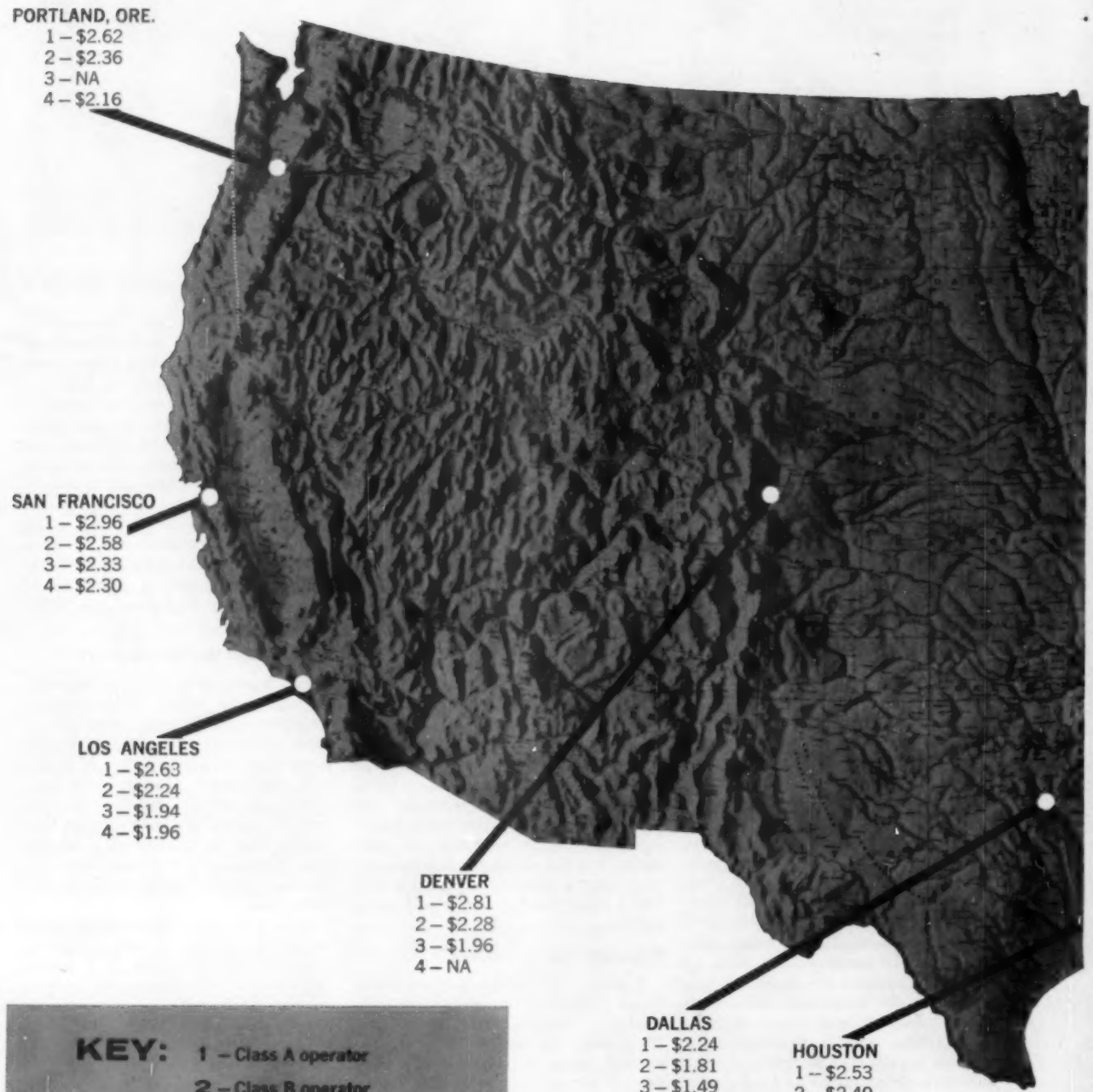
How about the community?

Yet important as state and regional variations in wages, labor supply, transportation, climate, taxes and so forth are in the selection of a new plant location, the selection of a specific community is even more so—always assuming that the general area of search has been limited to a region that is strategically located with reference to markets, raw materials, transportation, and service industries.

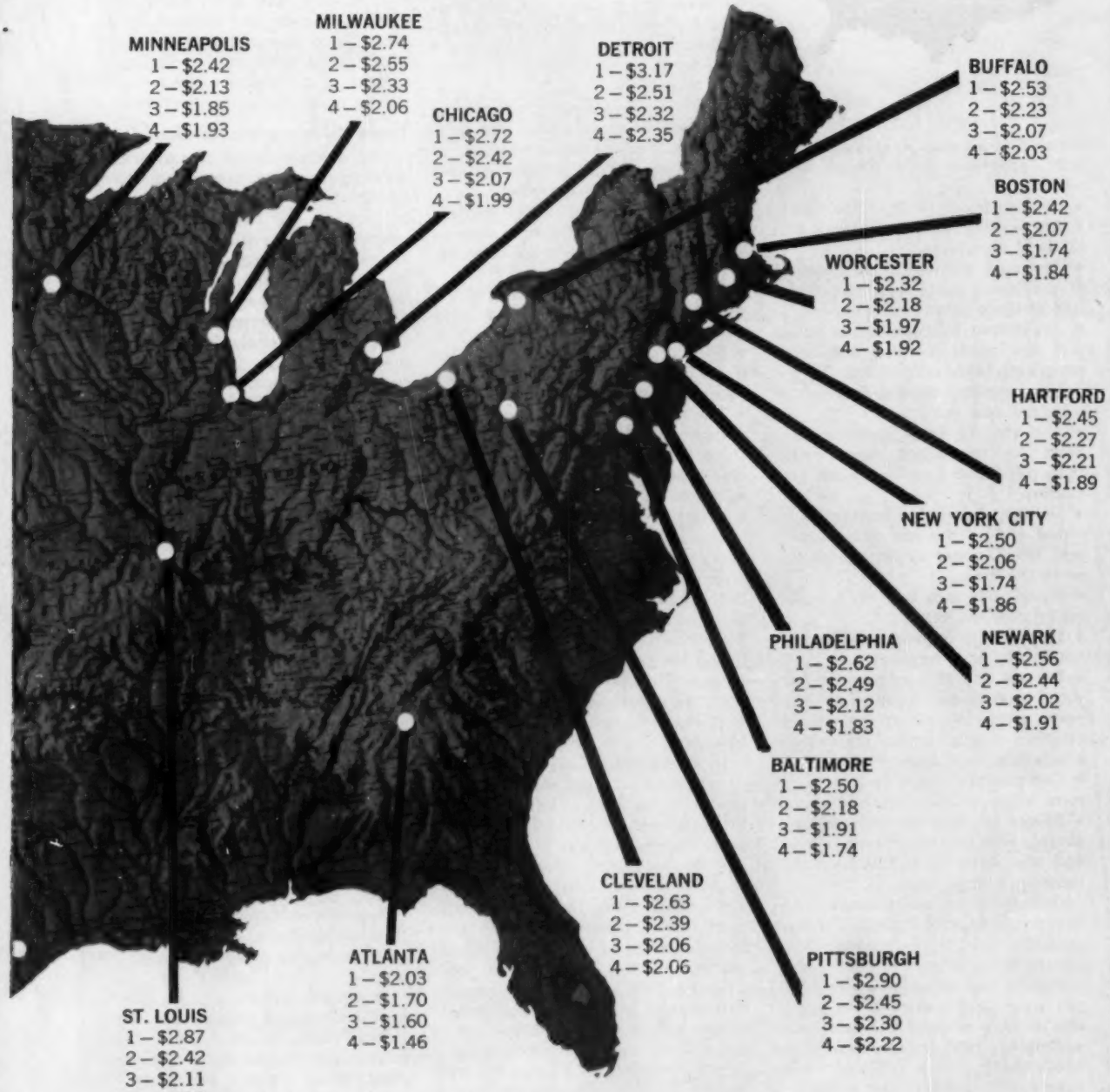
It is true that the smaller community is gaining in importance as a manufacturing center — a recent Department of Commerce survey showed that cities and towns of 50,000-or-less population now provide more than 25% of all manufacturing employment. It is also true that smaller communities frequently offer cost advantages in labor, taxes, site costs, plant overhead, etc.

But metalworking companies must not make the mistake of arbitrarily limiting area of choice by the size of a town. Whether a firm belongs in a metropolitan area, in a small city, or in a semi-rural town. Those firms

Average hourly wages for machine



operators in 22 US cities



U. S. relief map courtesy Aero Service Corp., Philadelphia

WHERE TO LOCATE YOUR PLANT

which find location in smaller towns most profitable tend to be those which:

- Require fewer skills at the outset.
- Are willing to train a large part of their workforce.
- Are more oriented to the assembly of purchased parts than to fabrication of those parts.
- Are forced by competition to accept low profit margins and hence must keep labor costs down.
- Use mostly catalog-ordered or standard raw materials.
- Are able to keep inventories on hand for production runs, rather than rely upon hand-to-mouth purchasing.
- Deliver mostly to customers at either end of the one or two main rail, truck, water or air routes that serve the town.
- Have customers who do not normally visit the plant.
- Have utility requirements that are not in any way unusual.
- Do not find it necessary to have such professional people as engineers, physicists, or mathematicians attached closely to their major manufacturing facilities.
- Can profitably sign up for a long-term lease, or lease-purchasing plan.
- Prefer the benefits of hiring employees who live closer to their work and who have more free time than those in a large city.

Obviously, no one manufacturing firm would exactly match all of these specifications. Nor would any firm exactly fit the pattern of the "typical" company best suited to a metropolitan area. Such a firm would possess one or more of these characteristics:

- Employs 1000 or more people and needs the big labor pools of a metropolitan area for proper staffing.
- Requires skilled workers at the outset.
- Has customers who must have easy access to the plant.
- Requires varied or unusual forms of shipment (particularly air freight or barge shipments).
- Requires significant numbers of technical people. Big cities may not be breeding grounds for technologists but they are points of concentration.
- Requires detailed technical advice from suppliers.
- Must ship to a large proportion of customers who are within the metropolitan area switching district.
- Uses equipment which requires frequent technical servicing.
- Relies upon inventory buying. Some firms even locate next door to the wholesaler's warehouse in an effort to cut inventory costs.
- Uses the physical presence of the plant to generate sales to a large proportion of the population.
- Requires a short-term lease, or possibly wishes to resell the building within a few years.
- Requires large-scale financing. On amounts over $1 million, the city is the place to find funds on an attractive basis.
- Wishes to avoid being the "biggest frog in the civic pond," which carries with it the doubtful privileges of being the main target for charity and civic improvement drives, and of bearing most of the blame for unemployment if workers are laid off.

Only after a company has established its goals, established its criteria, and has determined in a general way the geographic area it prefers, is it ready to settle upon a specific location.

In the selection of a community in which to set up a manufacturing operation, two sets of variables must be considered. The first involves tangible factors for which actual costs can be estimated: labor (bearing in mind that a labor rate does not always reflect true labor cost because productivity, absenteeism, and attitudes must all be considered), transportation rates, projected for both inbound and outbound movement; utility rates, including transportation where coal may be involved. Other specialized cost items peculiar to a given company may also be estimated, such as cost of training in an area where too few skilled workers are available, availability of a market for scrap, need for standby fuels, and such legal costs as unemployment and workmen's compensation rates.

However, the lowest cost location is not always the soundest one. Many intangible characteristics of a community, those for which there is no dollar and cents evaluation, can influence selection of a plant site.

For example, close attention must be paid to the frequency, liability and coverage of available transportation service. And apart from labor cost, the supply and attitude of the labor force is significant. The flexibility of a labor force—its ability to expand as a company expands—cannot be measured in terms of dollars.

Those all-important services

The availability of metalworking services can sometimes be important enough to dictate an ultimate choice of location. For example, successful operation may require easy access to mill supply houses, tool and die shops, instrument repair services (particularly where automation is important), important suppliers, freight forwarder service, air freight, and so on.

One of the most important intangible characteristics of a community is its suitability in terms of living conditions. The level of environmental, cultural and civic background of a community can have an important influence on the ability of a company to transfer key personnel into the area.

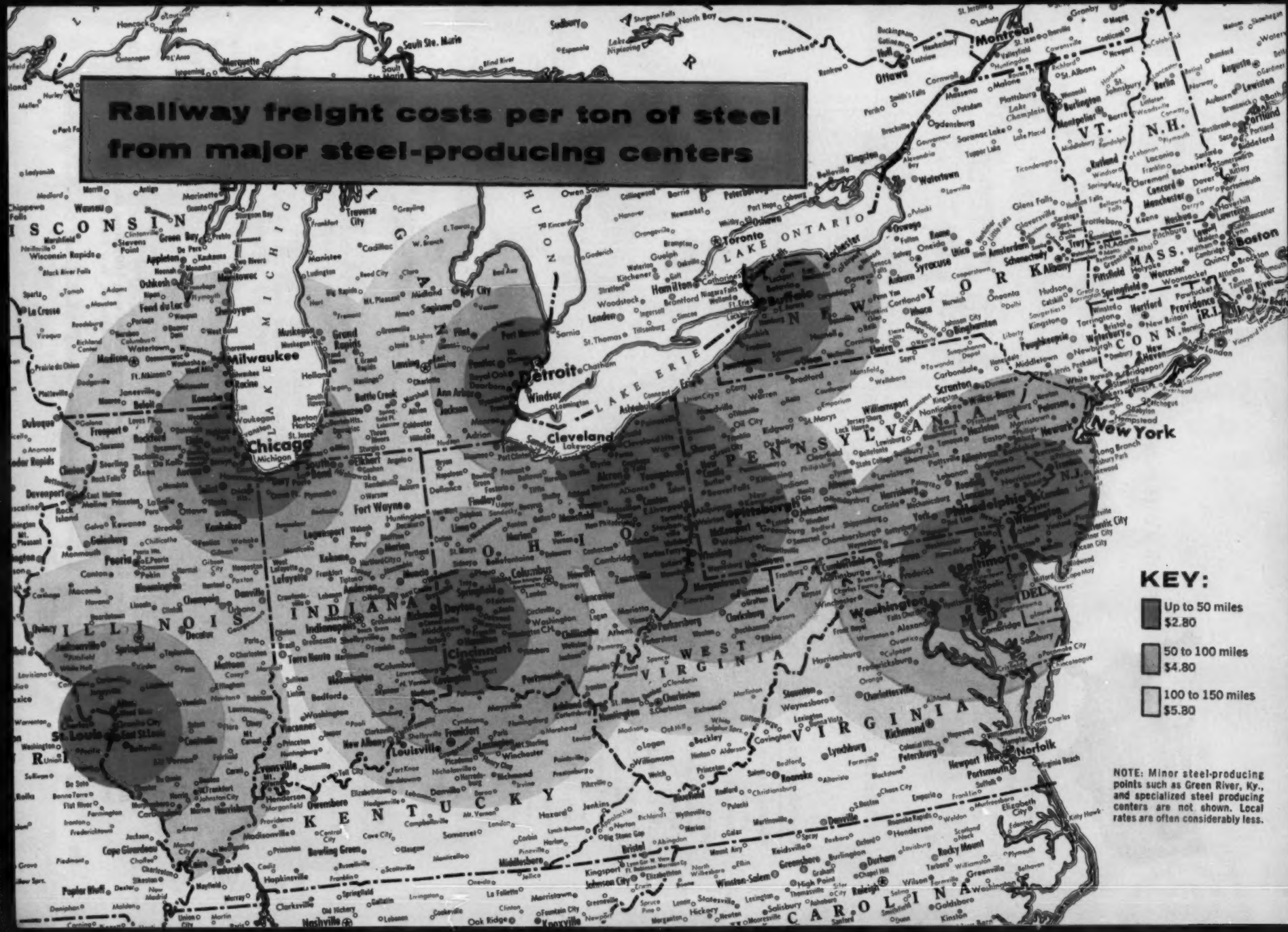
For instance, the pubic school system is important to those transferees with school-age children, and sometimes the availability of a parochial school is significant.

But even the most attractive community may be entirely worthless to a prospective plant if it does not have a site suitable for construction. The desirability of an industrial site must be measured not only in terms of initial cost, but in terms of how much it will cost to prepare it for use.

Frequently, local authorities will cooperate in preparing a site. They might, for example, extend utility lines or paved highways without cost. In some instances, local groups have even graded an otherwise unsuitable area.

Obviously, no site should ever be acquired without looking into its soil bearing characteristics, ground water availability (in the absence of municipal water lines), suitability for septic tank installation (in the absence of sewers), proper zoning, air pollution regulations, surface drainage, possible influence of noise and other nuisances upon neighbors, opportunities for expansion, amount and character of growth in the area and in the taxing district in which the site is located.

(Continued on page 128)


Railway freight costs per ton of steel from major steel-producing centers
KEY:
Up to 50 miles $2.80
50 to 100 miles $4.80
100 to 150 miles $5.80
NOTE: Minor steel-producing points such as Green River, Ky., and specialized steel producing centers are not shown. Local rates are often considerably less.
Chicago
Detroit
Cleveland
Pittsburgh
Buffalo
New York
Philadelphia
Baltimore
Washington
Cincinnati
Louisville
St. Louis
Milwaukee
Toronto
Montreal
LAKE ONTARIO
LAKE ERIE
LAKE MICHIGAN
ILLINOIS
INDIANA
OHIO
KENTUCKY
WEST VIRGINIA
VIRGINIA
PENNSYLVANIA
NEW YORK
CAROLINA

WHERE TO LOCATE YOUR PLANT

The final decision

Once complete data has been assembled on a number of possible sites, their respective merits, involving not only direct operating costs but intangibles as well, can be compared for a final decision. Incidentally, if relocation is involved, the prospective new locations should be compared not only among themselves but to the location which may be abandoned.

Once a final site has been selected, the cost of moving enters the picture, and this is something that is frequently and woefully underestimated, especially by small firms. In addition to the obvious costs involved in disconnecting and displacing machinery, loading it, moving it and reinstalling it, there are many hidden costs. One such cost is that of transferring personnel and their household belongings to the new location.

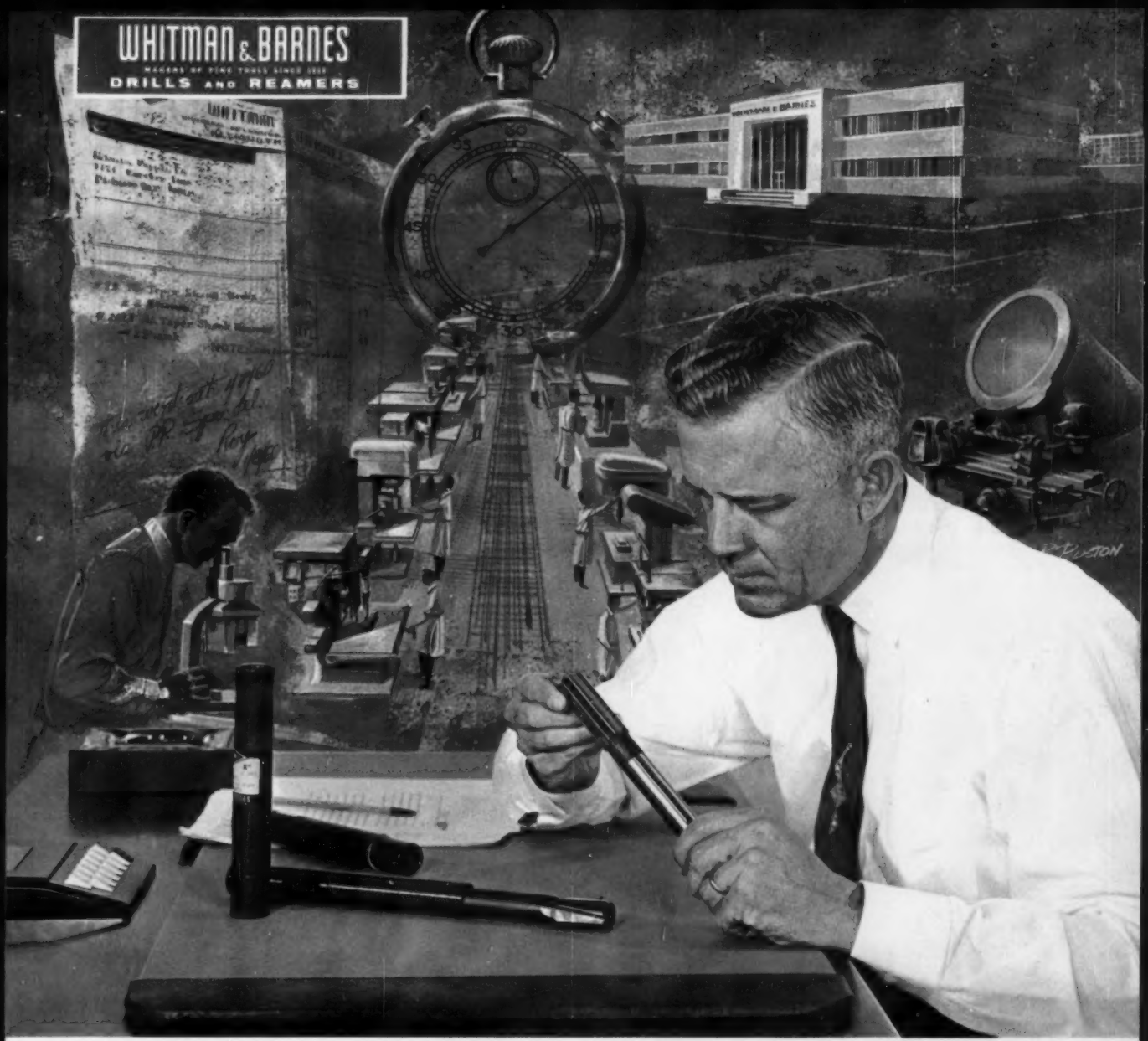
Another is the possible need for duplication of facilities if the move is not to be made all at one time.

Yet these moving costs are one-time charges and may be written off against the economies that the new location will effect. As a rule of thumb, if moving costs can be recovered (in relocation, not in establishing a branch plant) within two or three years, relocation is economically justified. •

ESTIMATED COST COMPARISON CHART FOR TYPICAL METALWORKING COMPANY (PRESENT LOCATION VERSUS RECOMMENDED COMMUNITIES)

Operating Expenses	Present Location	Community A	Community B	Community C	Community D
TRANSPORTATION					
Inbound	$ 202,942	$ 212,209	$ 207,467	$ 220,009	$ 216,778
Outbound	480,605	361,268	393,402	365,198	410,637
LABOR					
Hourly direct and indirect	$1,520,943	$1,339,790	$1,146,087	$1,223,416	$1,178,809
Salary	279,412	255,000	255,000	255,000	255,000
PLANT OVERHEAD					
Rent or carrying costs	$ 271,436	$ 290,000	$ 280,000	$ 295,000	$ 275,000
Real estate taxes	43,345	39,000	34,000	39,000	36,000
Personal property and other locally assessed taxes	16,899	—	—	8,500	—
Fuel for heating	19,260	11,000	9,500	13,000	16,000
UTILITIES					
Power	$ 56,580	$ 61,304	$ 41,712	$ 49,007	$ 43,112
Gas	18,460	19,812	13,767	16,633	14,986
Water	12,474	8,200	4,500	4,500	7,000
Treatment of effluent	6,376	—	2,300	—	3,400
STATE FACTORS					
State taxes	$ 67,811	$ 73,400	$ 44,920	$ 71,000	$ 58,250
Workmen's compensation insurance	30,499	24,000	14,000	17,000	21,000
TOTAL	$3,027,042	$2,694,983	$2,446,655	$2,577,263	$2,535,972
SAVINGS THROUGH CONSTRUCTION OF NEW PLANT					
New plant layout		$ 210,000	$ 210,000	$ 210,000	$ 210,000
Reduced materials handling		38,000	38,000	38,000	38,000
Elimination of present local interplant movements		60,000	60,000	60,000	60,000
Reduced public warehousing		30,000	30,000	30,000	30,000
Reduced supervisory personnel		27,000	27,000	27,000	27,000
SAVINGS THROUGH NEW CONSTRUCTION		$ 365,000	$ 365,000	$ 365,000	$ 365,000
ANNUAL OPERATING COSTS	$3,027,042	$2,329,983	$2,081,655	$2,212,263	$2,170,972
POTENTIAL ANNUAL SAVINGS OVER PRESENT LOCATION		$ 697,059	$ 945,387	$ 814,779	$ 856,070
PERCENTAGE OF SAVING		23.0%	31.2%	26.9%	28.3%

Reprints of this special report are available at 25¢ each (less for quantities over 100) from Reader Service Dept, American Machinist/Metalworking Manufacturing, 330 W 42nd St, New York 36, N Y.



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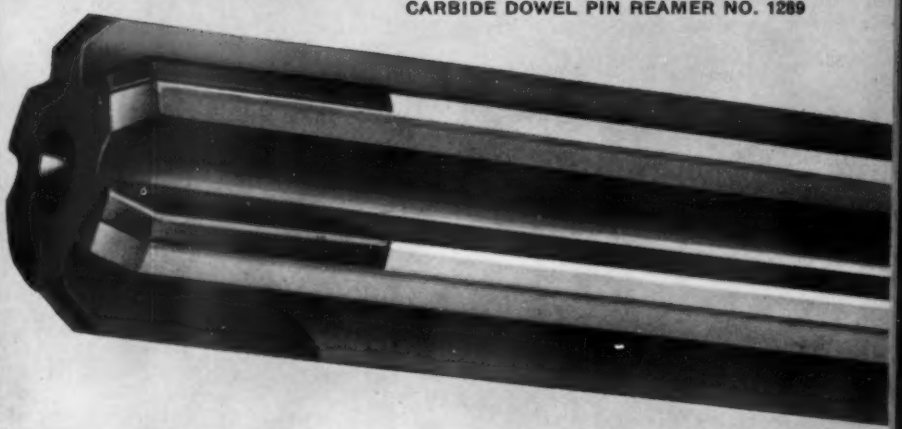

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Diaphragm-Type Relief Valve

Type 62AX— for use with air, water, oil and similar fluids. ⅛", ¼", ⅜", ½", ¾", 1" pipe sizes. For relief pressures up to 250 psig (⅛", ¼", ⅜", ½") and up to 125 psig (¾", 1").

Compact Diaphragm-Type Relief Valve

Type 40AB— for use with air, water, oil and similar fluids. ⅛", ¼" pipe sizes. Relief pressure adjustable up to 100 psig.

Pop Safety Valves

Type 1000— for air. ⅛", ¼", ⅜", ½" pipe sizes. Relief pressure ranges: 25 to 200 psig.

Flow Control Valves

Types 1100 and 1200— for air, oil, hot and cold water, steam, non-corrosive gases and liquids. Two-way and single-way valves. ¼", ⅜", ½" pipe sizes. Max. pressure: 250 psig on air and hydraulic systems, 125 psig on saturated steam and hot water systems.

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Type 61A— for air, water and non-corrosive gases. ⅛", ¼" pipe sizes. For relief pressures: 25 to 300 psig.

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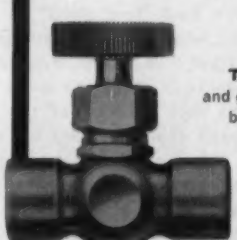

Type N— for air, liquids and gases that do not affect brass. ⅛", ¼" pipe sizes. Maximum pressure: 250 psig.

For complete information on these products or the complete Norgren line of compressed air filters, pressure regulators and lubricators, call your nearby Norgren representative, listed at left—or write for descriptive literature.

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Thompson's exclusive "CYBERMATIC PENDANT CONTROL" completely eliminates the elevating hand wheel

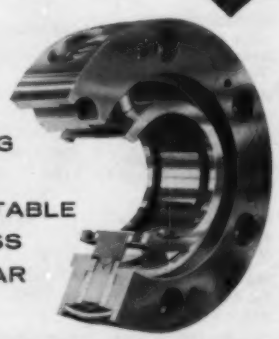
All vertical movement of the wheel head, both automatic and manual, on this modern Thompson 36 x 48 x 72 Type CX Plunge-Matic Grinder is accomplished effortlessly by dials on the Cybermatic Pendant Control.

This new pendant control performs the following functions: **Sets automatic down feed from .0002" to .006" in .0002" increments—sets the total amount of automatic down feed for stock removal from 0 to 1 inch through the entire 48" vertical capacity—controls automatic down feed increment (as pre-selected) at each reversal of the wheel head on cross feed or at each table reversal on straight plunge feed — controls a 20" per minute rapid traverse to the elevation of the wheel head—provides a push button to re-set the down feed range at operator's will — pre-sets a wheel dressing increment for automatic wheel trueing—compensates manually or automatically for wheel dressing —provides a master stop button for all movement.**

This Thompson machine is completely modern in every respect. Its features include the exclusive Thompson Hydra-Cool Hydraulic System with dual packless cylinders providing automatic cushioning. A separate automatic lubrication system for all sliding way bearings and tape bed way covers are standard equipment.

This modern Thompson grinder is both high powered and extremely accurate.

Further specifications will be furnished upon request.



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REFERENCE BOOK SHEET

Screw Machine Work on Aluminum—III

By M Bryan Baker, Kaiser Aluminum & Chemical Corp, Oakland, Calif

Trouble Chart for Drilling

Possible Causes	Corrections
Breakage	
Dull drill; lack of lip clearance; drill diving into work; forcing; excessive feed	Resharpen to proper angles; increase clearance behind cutting edges up to 17° at periphery with increase toward center until point angle of 135° or more is formed. "Hogging in" can be caused by too great a lip clearance; too little clearance causes riding, and failure to cut
Chips clogging flutes; insufficient coolant	Keep flutes and cutting edges smooth and free of metal build-up; steel-wool polishing often helps; coolant with more lubricating properties may be needed; or use a drill with greater helix—40° or more, rather than standard 28°; chipbreakers may be necessary; when drill bushings are used provide one drill diameter space for chip clearance
Speed too slow; defective center, drill "walks off" center; misalignment; loose collet; drill set too far outside of holder or bushing; backlash in work or spindle; another tool working in conjunction with drill may be at fault	Feed rate must be changed proportionately as speed is changed; decrease feed or increase speed. Defective center can cause deflection, poor entrance, eventual splitting or spalling due to unequal loads on lips. Centers, smoothly polished, correctly and evenly sharpened and solidly positioned seldom cause difficulty. Uneven lips cause drill to "walk" as does misalignment; use spot drill; check point, alignment, collet position; springing, belling of hole can result from too great deflection, or drill length. Insure that work is held rigidly, machine is not worn excessively nor has loose bearings
Variation in Drilled Depth	
Dull drill; drill cutting hard	At first sign of hard cutting, drill should be resharpened, and feed rate adjusted to support speed if dulling is consistent
Worn linkage between tool and cam; loose collet; end play in spindle lead, improper drill clearance; part variation	Insure that toolholders, machine, fixtures are in first-class condition. Variations may be intermittent or progressive; when progressive over a run, one or more components may be merely slipping or gradually loosening; when greatly variable, extreme wear is indicated
Oversized Holes	
Wrong size drill; improper grind; bent drill; lip chipped; poor alignment; loose spindle; floating holder defective; damaged center; land clamping	Check drill size; try smaller size; poorly ground drill can drill holes a size larger or more; unequal point angle or varying length of cutting edges can be determined by measurement; check straightness of drill, chipped lips, alignment, defective or dirty holders, play in spindle; improper center can cause drill to wander
Eccentricity of Holes	
Drill with larger included angle than center; faulty center; bent holder shank; bent stock; improper clamping	Drill may start untrue especially when the included angle is smaller than that of the center; check to see that center is rigid, correctly ground; use center drill; bent holder shank can sometimes be detected by noting whether drill turns out of true when running idle
Undersized Holes	
Size of drill too close to tolerance; dull drill; drill many walk off center; untrue hole may cause binding of gage; worn drill margins	Check hole size in thinner piece of metal; if noticeably tight, change to size larger; check for sharpness—a dull drill will generally drill undersize; inspect center and drill approach to guard against wandering, untrue hole; check margins of drill to determine wear

Continued on page 135

EX-CELL-O CONTOUR PROJECTORS GIVE YOU MORE—

1. **LARGEST WORK AREA**—Regardless of magnification there is a constant eight inches of work space from lens to focal plane to accommodate large objects. The Model 30 has a 12" diameter capacity.

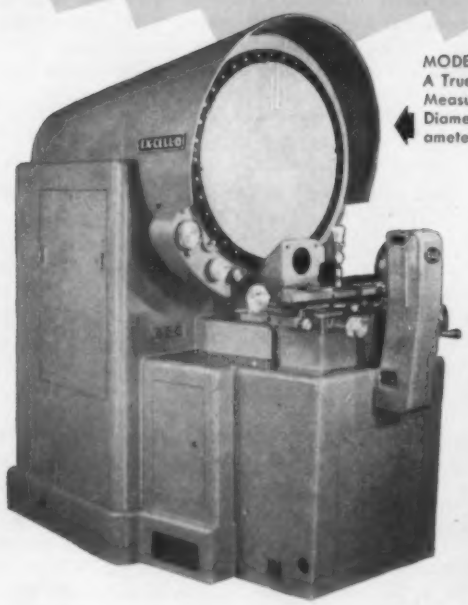
2. **UNSURPASSED ACCURACY**—Kodak optics with famed Ektar® lenses guarantee accurate measurements and give clear undistorted images over entire screen. You can depend upon optical decisions made on the Ex-Cell-O.

3. **TRUEST MEASURING PRECISION**—All Ex-Cell-O Contour Projectors read to tenths and measure to tenths. Each Ex-Cell-O contour projector is tested and checked to the highest laboratory standards before shipping.

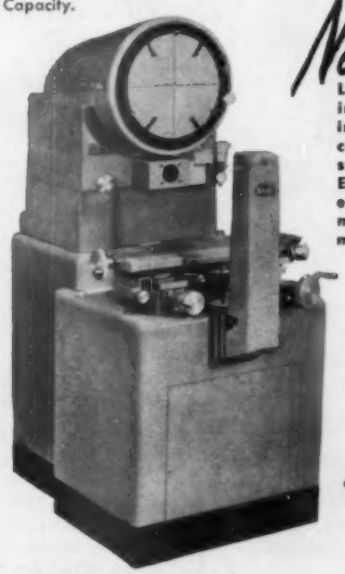
4. **BRIGHTEST GLARE FREE SCREEN**—Coated lenses and mirrors have been standard on all Ex-Cell-O models for many years. The patented "Fresnel" lens (exclusive with Ex-Cell-O) brings entire screen into clear view from normal operator position. Sharp clear images in normal room light—the brightest and clearest in the contour projector field!

5. **MOST RUGGED CONSTRUCTION**—Built to "stand the gaff." Solid construction with optical system locked into lifetime cabinets. Will withstand factory wear and tear—without getting out of adjustment. Guaranteed by Ex-Cell-O's long experience in the manufacture of precision machine tools.

6. **SIMPLEST OPERATION**—Finger tip controls, cool to the touch lamphouses, simple setting and measuring devices, unreversed images, all add up to comfortable day long operation. A precision machine of great accuracy that can be quickly mastered by average factory inspection personnel.



MODEL 30
A True, Heavy Duty Precision Measuring Projector with 30" Diameter Screen, and 12" Diameter Capacity.



New! **The Ex-Cell-O Mercury Arc Light Source Accessory. A high intensity Accessory light source including Mercury Arc Lamp, special collimator and auxiliary power supply. Quickly adaptable to all Ex-Cell-O Contour Projector Models (except Model 8) to give maximum screen brightness at higher magnifications.**

Write for new booklet "See The Savings" which graphically demonstrates time savings through optical gaging over conventional methods.

MODEL 14-5
The Finest, Most Versatile, 14" Screen Contour Projector Available.

Manufactured by EX-CELL-O Corporation of Detroit, Mich.

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26 FORBES STREET **ROCHESTER 11, N. Y.**

(A subsidiary of EX-CELL-O Corporation)

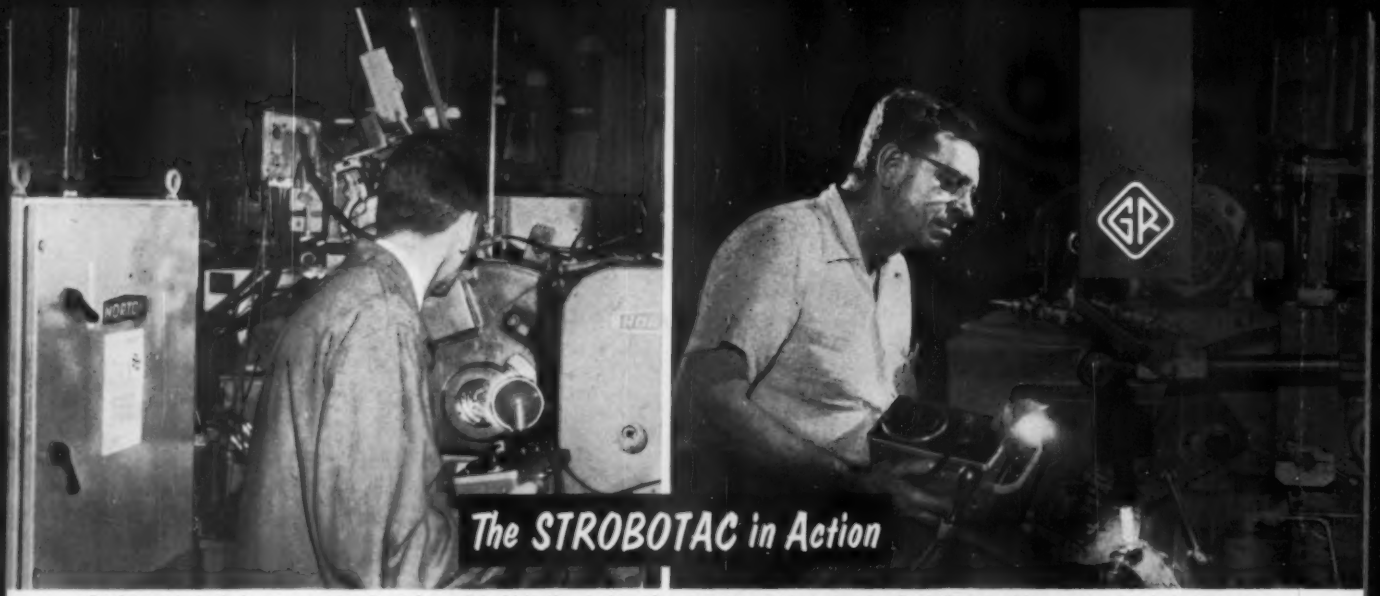
Screw Machine Work on Aluminum—IV

Trouble Chart for Drilling—*Continued*

Possible Causes	Corrections
Rough Holes	
Improper grind; chipped lip; defective lands; clogged chips; dullness; lack of coolant; wrong lubricant; too much pressure	Examine for unequal clearance of lips or lip angle as one side cuts deeper, deflecting the drill; improper grind can cause spalling, chipping of lips and margins and consequent roughness of holes; dullness may well result in excessive feed pressure and cause deflection and roughness; inadequate chip disposal may call for thinned web
Tapered Holes	
Bent drill; misalignment; poor center, drill bushing; defective bearings; squeezing of hole	Check for bent drill, especially near base; misalignment can be caused by chips between drill shank and holder, or worn components; check center hole and drill approach, determine if included angles of each are equal; note if there is play in bearings or other components
Chipping of Lip or Cutting Edge	
Excessive lip clearance; too much pressure	Too much clearance of cutting area can cause "hogging in" and chipping of lips; excessive clearance weakens the cutting edges (review drill breakage); too little lip clearance can cause rubbing and failure to cut, with resultant excessive pressures; this causes heat and strain

Trouble Chart for Counterbores

Possible Causes	Corrections
Breakage or Chipping of Edges	
Dullness; wrong size tool; hole eccentric between steps; coolant insufficient	Sharpen carefully (see below), to insure all steps are concentric with each other as well as shanks; diameter of a counterbore, for reaming to size, should be approximately halfway between the mean and top limit of hole size, except for fragile conditions where tool size may be somewhat smaller; check for concentricity of each diameter in a stepped hole, examine combination or step drill for fault
Chatter, Poor Finish	
Resharpening needed; wrong clearances; margins too wide; rough tool; chip packing; metal buildup; lack of rigidity; fault of previous operation	Check grinds; for cutting solid stock, flutes should be set at about a 23° helix for counterbores under 1 in. Flues are often straight-milled at an angle of about 10° to tool axis, and 5° to the radius for a positive rake. Lip angles approaching 60° will generally serve, depending upon shoulder angle desired for the part. Web thickness of tools for drilling into solid stock should be thinned to reduce pressure needed for penetration, seldom exceeding 1/16 in. at the point. Speeds will approach 700 fpm and feeds can parallel those for a similar sized drill; for wider steps or flat bottoming, feeds down to nearly 0.002 ipr may be required. Clearances back of each lip run about 12° for the free-machining alloys and 15° for others
Tolerances not Maintained	
Dullness, wrong angles; machine bushings, ways and spindles loose; previous operations off tolerance; cut too shallow or feed too light	Sharpen as recommended above. All loose bearing members should be corrected. Determine and remedy faulty previous operations. Increase feeds (note typicals above); see that all elements in operation are aligned, rigid. Coolants, properly applied in ample amounts, often help



Stroboscopic techniques are an extremely useful aid in the design of machine tool components such as this Automatic Grinding-Wheel Balancer manufactured by Norton Company. This device reduces wheel balancing time to 5 seconds, and eliminates vibration that might cause chatter. The new Strobotac, with its "long-throw" beam of intense white light and extremely short flash duration, shows up nearly hidden mechanical details of the Balancer's operation.

Checking critical speeds of rotating machine parts and observing performance under actual operating conditions are two jobs readily handled by the Strobotac. At Norton Company, the Strobotac checks operation of an automatic cam-shaft grinder. In order to obtain the best possible finish on the cam surface it is desirable to grind at high speeds, yet for safety reasons the wheel should not be operated above rated speed. The Strobotac's flashing rate stability and 1% accuracy make it possible to hold circumferential velocity of the ALUNDUM vitrified wheel to an exact pre-established point below rated speed.

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for the Design of Better Machine Tools

Consider the new Strobotac and its benefits as an aid in the design, test, and quality control of your product. This unique instrument lets you observe cycling machine parts and functions as though stopped or in slow motion while the apparatus is running at normal speed. Strobotac's concentrated beam of high intensity white light, probes into the heart of complex machinery. The instrument's extremely short-duration flash virtually eliminates blur and shows up details of mechanical motion formerly impossible to see.

For speed measurement, the Strobotac serves as an accurate tachometer. It is preferable to other speed measuring devices because no contact with the machine is necessary and no power is absorbed.

Write for more information or, better yet, contact one of our district sales engineering offices and ask for an on-the-job trial of the new Strobotac.

TYPE 1531-A STROBOTAC®
Electronic Tachometer and Motion Analyzer.
. . . $260.

Flashing-Rate Range: 110 to 25,000 flashes per minute direct-reading; useful for speed measurements to 250,000 rpm.

Accuracy: ±1% of dial reading — permanently assured by neon-bulb calibrator on instrument panel.

Flash Duration: 0.8, 1.2, and 3.0 millionths of a second for high-, medium- and low-speed ranges, respectively.

Peak Light Intensity: 0.21, 1.2, and 4.2 million beam-candlepower (minimum) on high-, medium- and low-speed ranges, respectively.

External Triggering: May be triggered with a mechanical contactor on 6-volt peak-to-peak signal.

Power Supply Requirements: 105-125 (or 210-250) volts, 50-60 cycles or 400 cycles.

Mounting: "Flip-tilt" case serves as adjustable stand and handy carrying case.

Weight: 7⅛ pounds.

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Cutting Time for Power Hacksaws

By Tyler G Hicks, mechanical engineer

If a power hacksaw has positive feed, the time to saw $T = L/Sf$ where:

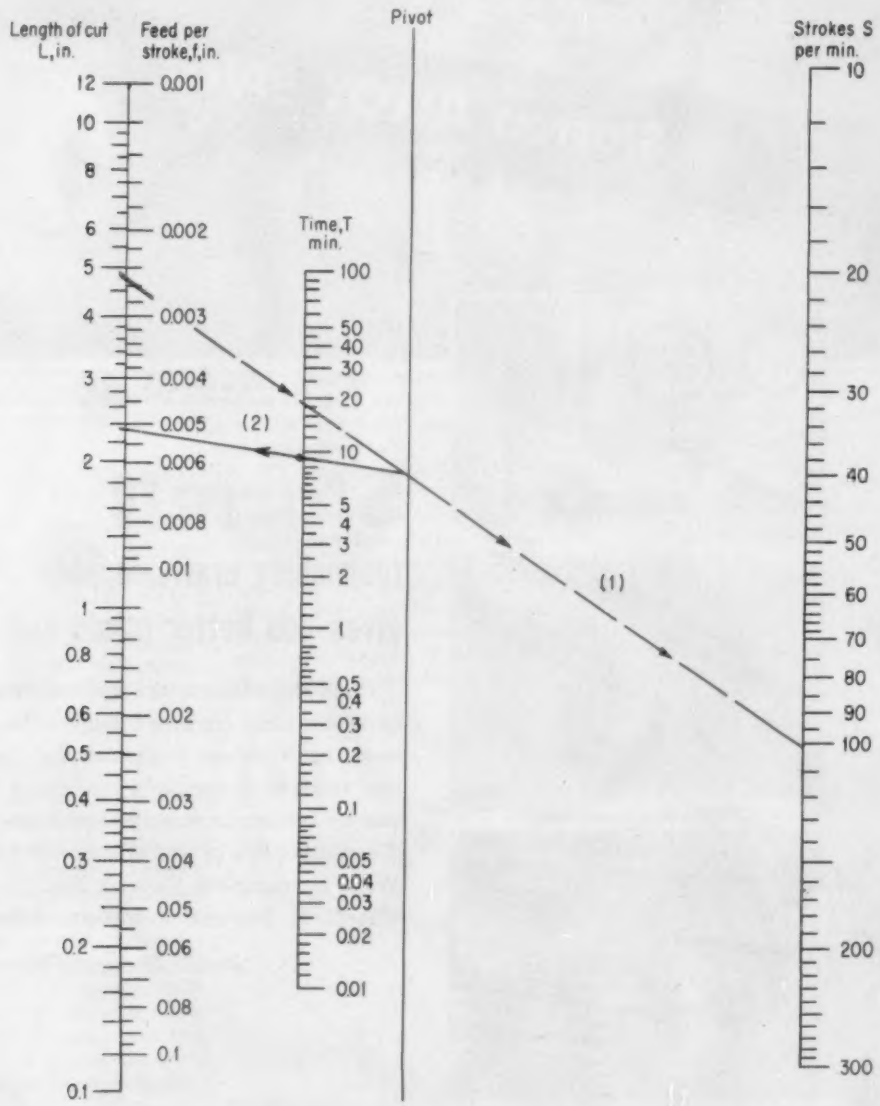
T = minutes
L = length of cut
S = strokes per min
f = feed per stroke, in.

Problem: Time to saw 5-in. tool-steel bar, at 100 strokes per min.

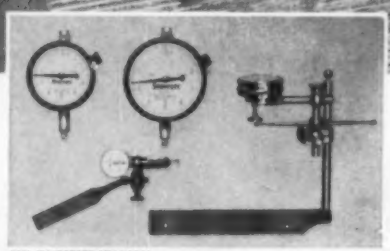
Solution: Enter chart at cut dia = 5 in. and connect with 100 strokes per min. (line 1). At intersection with pivot line, project left (line 2) to feed = 0.005 spm. On T scale, read time = 10 min.

Note: Strokes per minute for brass and copper = 140; for hard steel, 70.

	Feeds per Stroke		
Stock Dia	Annealed Tool Steel	Brass, Copper	Pipe, Tubing
1	0.014	Max	Max
2	0.012	0.020	Max
3	0.008	0.016	0.020
4	0.008	0.010	0.016
5	0.005	0.007	0.012
6	0.003	0.007	0.008



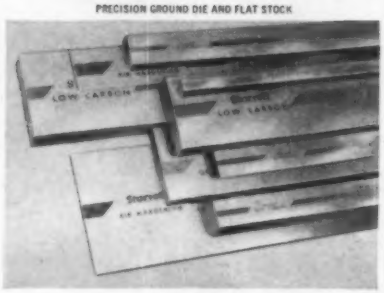
HACKSAWS, HOLE SAWS, BAND SAWS, BAND KNIVES — Starrett ALLOY BAND Double Carbide and SAFE-FLEX® High Speed Steel Band Saw Blades, REDSTRIPE® S-M High Speed Steel Hacksaw and SAFE-FLEX® High Speed Welded Edge Hole Saw.



DIAL INDICATORS AND GAGES

PRECISION TOOLS

PRECISION GROUND DIE AND FLAT STOCK



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World's Greatest Toolmakers

Talking Shop

NANWEP

OUR ONLY EXCUSE for talking about the weather is that everybody else does and that we've learned that the Navy is attempting numerical weather prediction. (Now go back and look at the initials heading this item.) Tape feeds weather data and the computer, after some 300,000,000 computations, produces a map showing atmospheric pressure at each point for the desired time, usually 24 or 48 hours ahead. The operation takes 40 min.

Source of our information is *Readout*, published by Ampex. However, we regret to report that the Ampex editor asked if the computer would hazard a guess at the weather in Monterey the next weekend. It did. He went. It rained.

Quote

"A TRUE INCREASE in productivity is the only valid way America can hope to compete with Europe and Asia or justify increased wages without inflation. The U S must change its conservative attitude on investment in modern cost cutting machinery." —James C Kelly at an ASTME meeting in Chicago.

Drawing Compounds

PERVERSELY it seem the most effective drawing compounds for tough operations are the ones that cause the most problems in cleaning. Because we tend to concentrate on the tough problems, we talk most about these exasperating but effective mixtures. Look at a fairly simple operation: 20-gage blanks 36 x 40 in. drawn to a depth of 4 in. This gives a lot of leeway in choice of compound and Oakite tells us of a manufacturer who chose a water-soluble compound in which parts were dipped at room temperature. The thin film was adequate for the draw and easily washed off before welding and painting. They say the manufacturer made the choice seven years ago and is still using the same compound. That's a bit remarkable in an area where the temptation to experiment is often irresistible.

Dining in Space

FROM THE DESIGNERS of the first space kitchen, comes word of plans shaping up at Whirlpool Corp (on an Air Force contract) for food service to astronauts in flight. Canned and processed foods will be in containers made like toothpaste tubes because of the problems of weightlessness. Perhaps the idea of steak squeezed from a tube appeals to you, but we've just cancelled our reservation for Mars.

Explosive Forming

AT THE SAE MANUFACTURING FORUM in Los Angeles there was a display of more than 100 parts that had been formed by explosive methods. They ranged from parts you could hold in your hand to parts 6 ft in dia. As one visitor was prompted to remark, "high-energy forming has moved out of the laboratory and onto the production line."

We can also report that the argument over whether there is springback in explosive forming still rages. Those that claim there is would seem to have the advantage since they say they have detected it, but because part and die springback together it can't be measured after the operation is over. This is an argument hard to counter.

Automated Machine

SOME ANONYMOUS ENGINEER has produced the following description of an interesting machine and we are indebted to Phil Warren of Heald for sending it to us:

"A Cow is a completely automated milk manufacturing machine. It is encased in untanned leather and mounted on four vertical movable supports, one on each corner.

"The front end of the machine contains the cutting and grinding mechanism, as well as headlights, dog catchers, air inlet and exhaust, a bumper, and a foghorn.

"At the rear, the machine carries the milk-dispensing apparatus as well as an automatic fly swatter and insect repeller.

"The central portion houses a hydrochemical conversion plant. Briefly, this consists of four fermentation and storage tanks connected in series by an intricate network of flexible plumbing. This part also contains the central heating plant complete with automatic temperature controls, pumping station, and main ventilating system. The waste disposal apparatus is located to the rear of this central section.

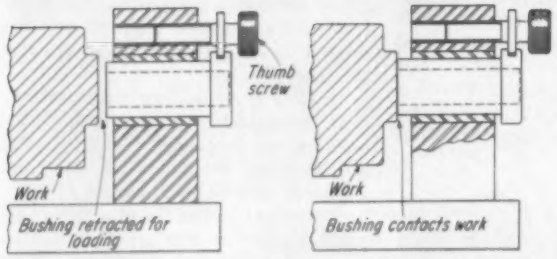
"Cows are available in an assortment of sizes and colors. Production output ranges from two to twenty tons of milk per year.

"In brief, the main externally visible features of the Cow are: two lookers, two hookers, four standeruppers, four hanger-downers, and a swishy-wishy.

"There is a somewhat similar machine known as a Bull, which should not be confused with a Cow. It produces no milk, but it has other interesting uses. •

Practical Ideas

Adjustable Bushing Aids Gun Drilling



The failure of a drill bushing to guide the drill sufficiently close to the work constitutes a major problem in gun drilling. When the drill is properly guided as it comes in contact with the work, a marked improvement in accuracy and finish can be seen. In most cases, however, the bushing is permanently affixed to the jig or fixture and then has, necessarily, be set back far enough to clear the work for loading and unloading.

The sketch illustrates a bushing that can be adjusted to contact the work while the machining is in progress and retracted for loading. It is brought forward, once the jig is closed, by a mere twist of a thumb screw.

As the bushing will have to have a sliding fit, the bore in which it is mounted has to be one or two thousandths larger than the usual press-fit hole. A notch is ground on the bushing head to slip fit the shoulder on the thumb screw.

When a hole has been drilled and tapped for the thumb screw, at the proper distance from the bushing hole, the screw and the bushing are inserted simultaneously. As shown at left in sketch, the bushing is slightly withdrawn to allow loading the workpiece. View at right shows the bushing advanced to contact the work in readiness for gun drilling.

R Dulek, Racine, Wis

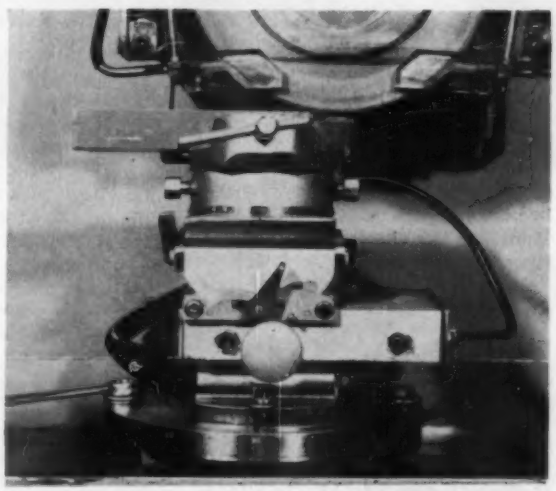
Swivel Base Adds Flexibility to Grinder Vise

Shortly after getting our new electrolytic chip-breaker grinder, we discovered our setups were too costly because of the limitations of the vise furnished with the machine. This was particularly a problem when, on our larger carbide tools, double chip breakers were required to have them do double duty as turning and facing tools.

Two chip breakers had then to be ground on the same plane, but at 90° to each other, blending at the cutting corner of the tool. To do this, it was necessary to first level the tool and then set the front angle. Once this was done, the tool had to be swiveled 90°, still keeping it level so the two chip breakers blend properly. But, because the vise lacked a fourth movement, any change other than swivel would change the level of the tool.

We therefore decided to rebuild the vise. Using stainless steel, to resist the corrosive action of the electrolytic salts in the solution, we made a sandwich construction of two ½-in. plates. Two radial slots were milled through the top plate for screws to lock it at desired angles. Graduations from 0 to 90° were marked on its edge as was a witness mark on the edge of the bottom plate.

Now after we have finished the first chip breaker



we have only one movement to make on the new swivel base and we are set to grind the second one.

A J Chevrette, Ordnance Dept, General Electric, Pittsfield, Mass

Hole in Surface Plate Aids Scraping Job

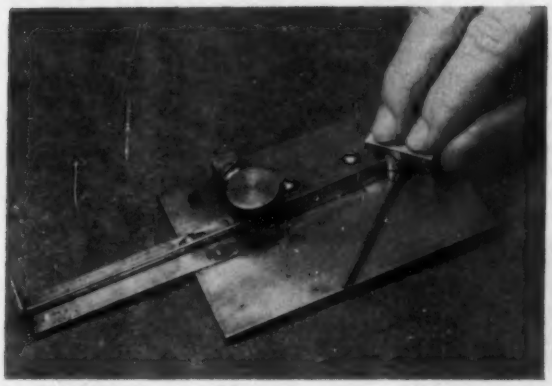
We sometimes run into scraping jobs on pieces having projections or bosses. This makes it difficult to properly seat them on a surface plate for spotting.

But the solution is simple. We have bored a hole through the plate large enough to accommodate the projection with clearance to spare. It is now easy to do a first-class job as the entire surface to be scraped can be spotted at once.

The hole won't harm the plate for its normal uses; in fact, we frequently find the hole convenient for jobs of similar nature and for layout work.

H J Gerber, Stillwater, Okla

Simple Tool Makes 180° Tube Bend Safely



A corrosion test required a 180° bend in 1/16-in. OD tube as the exposure element. Wall thicknesses varied from 0.008 in. to 0.004 in. and a uniform bend, without flattening or splitting, was necessary; hence the need for a Cerro-bend fixture.

To fill this demand, the tool shown in the photo was made. Though simple, it meets all requirements: It has an adjustable stop to control length from the bend. By way of a split clamp it secures the tube stock, and it has a guide and an arbor. All components are mounted on a plate which helps to make the tool easily portable.

Since no great force is necessary to bend the stock, a small bending block is used with which to roll the tube. The block has a groove with a radius to conform to the tube and at the same height as the groove in the arbor. It is gripped with the fingers and, beginning from the right, and going clockwise, wraps the tube around the arbor.

Materials in the tubes are: carbon steel—304, 316, and 317 stainless steel—nickel—Monel—Hasteloy—Carpenter 20—Inconel—and Niconel.

R W Louwien, Bishop, Texas

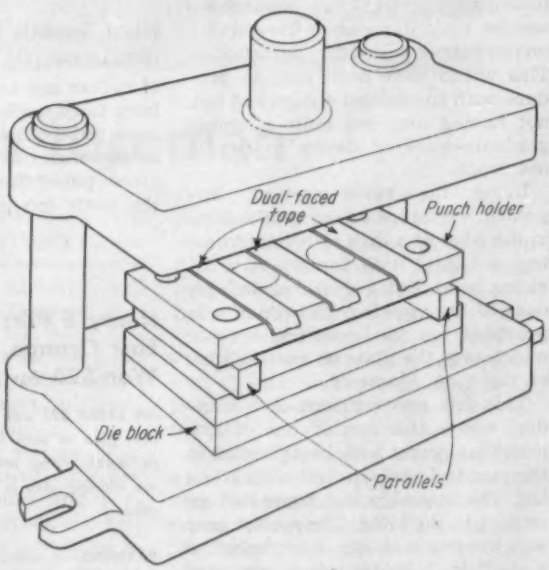
Dual-Faced Tape Simplifies Die Construction

Retaining the location of a punchholder in relation to the die is sometimes difficult when the two halves of the die set are sandwiched together. If other critical components are already positioned, leaving little or no room for C-clamps, it's particularly tough to keep the holder in place for transferring mounting holes.

When this problem comes up in our shop I have a simple solution. After locating the punchholder on parallels so all punches engage their respective die openings, I place a few strips of dual-faced tape (cellophane tape coated on both sides) on top of the punchholder. I then slip the top half of the die set on the guide pins and allow it to contact the tape. A tap or two on the die set with a lead hammer assures a firm grip by the tape; strong enough to separate the die set for the hole transfer.

The rest is routine. The screw-hole locations are spotted, the punchholder pried loose and the holes drilled and tapped. Once the punchholder has been mounted, with screws and the tape removed, the die set is again assembled for final alignment of the punches. Dowels are then drilled and reamed for and inserted.

Gerald Millerwise, Sebewaing, Mich



Simple Arithmetic Converts Taper Per Foot to °Angle

When a compound is used for turning tapers given in inches per foot, a conversion to a degree angle is necessary to set the compound. This can easily be arrived at by trigonometry, but for the lathe operator, not too well versed on trig, the fraction $\frac{19}{8}$ is all he has to remember. With this fraction he gets the angle between a side and axis of the work—the angle at which he'll set his compound.

Here's how the fraction is used: simply multiply the taper per foot by $\frac{19}{8}$. For example: a taper of ⅝ in. per foot is $\frac{5}{8} \times \frac{19}{8} = 1\frac{31}{64}$ or 1°29′4″. By trigonometry it figures 1°29′31″. This shows the simple method close enough to the theoretically correct one, that the error is too small to make any practical difference.

For tapers to around 4½ in. per foot, the greatest error will be about 2 minutes. Any angle steeper than this will generally be specified in degree angle on the drawing.

M W Loftus, Chicago, Ill

Shop-Made Tooling Graduates Vernier Plate

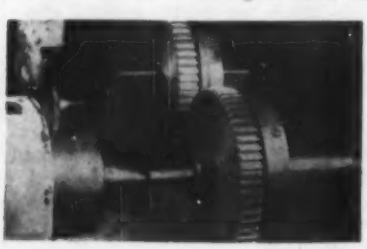
We build a number of small machine-tool accessories in our shop. These are made in relatively small quantities so it is necessary to economize by fabricating our own tooling whenever possible.

As an example, one job—a small universal dividing head—required a vernier plate to measure five-minute increments on its tilt adjustment. This would have been easy to produce with specialized equipment but, not having any, we built a simple graduate-marking device to handle the work.

Using the roller-marking approach, we milled raised graduations in the edge of a disk of non-deforming tool steel with the aid of a dividing head. Extra clearance on both ends of the marking-die section was provided for the mounting screws, which held the plate on another disk of the same diameter.

This disk was mounted on a mandrel which also carried one of two matching gears; both being keyed to the mandrel and clamped with a hex nut. The assembly was supported on centers in the lathe. The second gear and the marking die were keyed to a shaft in a holder which mounted on the compound rest.

In operation, the two gears are meshed so the marking section of the die coincides with the space between the screws on the mandrel disk. Next, the gears are rolled open and a stainless-steel plate is affixed to the mandrel disk with the screws. When the gears are again rolled back—with a handle attached to the gear in the die holder—the die makes impressions on the plate to a depth set by the compound feed.

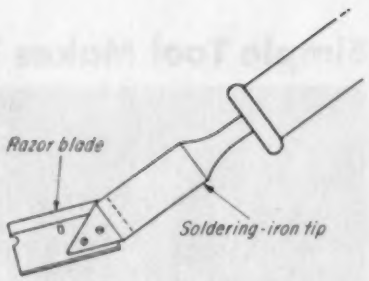


To retain its curve, and to eliminate additional tooling, the plates are numeral marked on the disk used for making the graduations. Neat markings are obtained by mounting the heavy arbor section in a hole bored in the side of a block parallel and then securing a stamp guide on top of the parallel to align the stamp. This setup is similar to the one I described in AM—Nov 2, '59 p134.

H J Gerber, Stillwater, Okla

Heat Speeds Rubber Cutting

In model making, components made of rubber are sometimes needed and have to be made up to suit. You then have to be quite handy with a knife as the material is usually too thin (from paper thickness to ¼ in.) and the parts too intricately shaped to be cut cleanly enough on a band saw.



Normally, the procedure is to make a metal templet of the required size and shape by conventional methods. The next step is to cut around the templet with a razor blade—and here is where the problem comes in. As a result of the resistant qualities of rubber, we would formerly end up with jagged, distorted parts of poor quality.

But this is a thing of the past. By maintaining a steady heat on the razor blade, it cuts through the rubber as if it were butter.

To achieve this, I made a diagonal slit in the end of a soldering-iron tip and locked the blade in the slit with a pair of setscrews. The sketch shows blade set at an angle most convenient for our purpose but the angle can be changed to suit almost any need.

Edward Di Gion, Paoli, Penna

Henry E Piltz
East Orange, NJ
Won $25 for his idea:
Indexing Collet Block is Handy Workholder
in the Oct 3, 1960 issue

AN EXTRA $25 will be paid for the best Practical Idea in each issue of *American Machinist/Metalworking Manufacturing*. Selection of the winning idea is made by a group of our readers.

PAYMENT—in addition to regular rate for item published—will be made as soon as tabulations are completed. The winner or winners—in case of a tie when duplicate prizes will be awarded—will also be announced in these pages.

JUDGES . . . are a group of *American Machinist/Metalworking Manufacturing* readers who select articles they prefer in a particular issue. This group changes entirely with each issue and represents a true cross-section of our readers. Their decision is accepted by the editors, without reservations or bias, as final in each case.

REQUIREMENTS—All items appearing in the Practical Ideas pages are eligible. They must be submitted by the originator on an exclusive basis. Do not worry about your shortcomings as an author, draftsman, or photographer—every item will be edited in accordance with *American Machinist/Metalworking Manufacturing* standards. Readers will judge only the finished product—in terms of its usefulness to them.

WHO MAY ENTER—Anyone may enter except employees of McGraw-Hill Publishing Co. Inc., and those of its advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER—Send all entries to: "Practical Ideas Editor" *American Machinist/Metalworking Manufacturing*, 330 West 42nd Street, New York 36, NY.

Harold L Warner

has spent his entire working life with Cadillac, started with the firm back in the days of touring cars as a freshout-of-high-school assembler. Lift the hood of one of today's sleek models and you'll find at least half a dozen innovations he has developed in his 33-year rise to division general manager

Shop man to top man

It is a rare thing for a shop man to rise to a top post in the highly competitive, sales-oriented automobile industry. But soft-spoken, pipesmoking Harold G Warner has made the climb from wiring assembler to general manager of GM's Cadillac Division in just 33 years.

But then the Cadillac is an unusual car—so long ingrained as a status symbol in the minds of the American people that it sells almost by itself as fast as it can be made. At Cadillac, it is more a matter of extracting another ounce of efficiency out of elderly assembly and manufacturing plants than of a powerful sales pitch.

Cadillac's new boss knows his plush product from the inside out, has in fact been responsible for some of the more notable developments under its hood. This South Dakotan has made Cadillacs his lifelong career, starting in with the company in 1927 immediately after graduation from high school as an electric wiring assembler, a job reflecting a childhood interest that persists today. A year later, he entered General Motors Institute as a Cadillac-sponsored cooperative student. "I'd still recommend GMI. The work and study program there builds aims and establishes direction."

Predictably, the school aimed Warner into a lifetime career of producing Cadillacs—he has held jobs ranging from foreman on the paint line to works manager. His toughest job, oddly enough, wasn't on Cadillacs, but it was for Cadillac.

At the start of the Korean War, Cadillac won a big production order for Walker Bulldog tanks, and as is usual with a crash program, the first unit was unrealistically scheduled to roll off the line just nine months later. There wasn't even a line. The Cleveland Ordnance Plant assigned to the project at that time housed 360 freight car loads of beans and tires.

Warner modestly credits his then boss, Bill Davis, for the fact that tanks started spewing off a makeshift assembly line two months ahead of schedule. Davis, however, tosses a big share of the kudos right back at Warner.

Production was soon running at 125 tanks a month, and by contract's end cost to the government had dropped to 55% of the original unit price. Among the vital lessons learned from Cadillac's experience: Armor steel castings can be machined by conventional tools, but only at light loads and at woodworking speeds. Prior to this discovery, Warner's men would lose a cutter in one pass and, as he puts it, "You couldn't grind *everything*."

Another interesting, Warner-headed project: putting the auto industry's first true high-compression V-8 engine into production. This Cadillac powerplant, introduced in 1949, also formed the design base for Oldsmobile's engine, and is still produced today by both companies.

Actually, Cadillac had built prototypes for this engine as early as 1937 and had targeted the program for 1943. But World War II intervened and the postwar delay was for lack of suitable fuels.

During early research on this Kettering-inspired design, it was found that combustion chamber accuracy had to be kept to a tolerance of 1cc or better. Cadillac foundry people claimed this could be achieved, but Warner countered that warpage

would preclude such accuracy. As seems to be usual, he was right. But the problem landed right back in his lap—because no combination of tools in existence was capable of machining the original contour of the combustion chamber.

"Fortunately," Warner notes, "manufacturing and engineering are closer together at Cadillac than at any other automaker." He was therefore able to persuade engineers to redesign the combustion chamber so that it could be worked with a combination of form and angular plane cutting—a method still in use today.

Although Cadillac owners, or even dealers, probably don't realize it, Harold Warner is generally credited with increasing the interval between valve grinds from 20,000 to 80,000 miles. One immediate advantage of this, aside from customer satisfaction, was a reduction of spare parts stocks by 80%. And with all this, manufacturing costs were cut.

Previous method had involved machining the valve guide channels with multiple-spindle heads, reaming the valve seats, and then inserting and hand-cutting the guide. However, the length of the hole was seven times the diameter—nearly twice the ratio considered practical for precision boring. The auto industry had lived with this problem for years, and so had its customers.

By chance, Warner was talking to a Carboloy engineer, who mentioned that Young's Modulus for carbide was between 70 and 80 million.

"It didn't ring a bell at the time," Warner remembers, "Then one day it struck me that the modulus for tool steel was only 30 million. I got in touch with Carboloy and asked if they could fashion a boring bar of their material. They did.

"Fearing chatter, we rigged up a clutched tooling lathe. It worked. We found we could reduce our hand-cutting requirement from 100% to 2%."

This makeshift operation ultimately developed into the Hoern & Dilts boring machine, now manufactured by New Britain and which in one form or another is pretty much standard in the auto industry.

People marvel that Cadillacs, given reasonable care, will run 100,000 miles with less than 0.001-inch cylinder bore wear. Warner is responsible (with a big assist from Cadillac engineer Norman Chambers)—Cadillac cylinder walls are held to a controlled roughness by using a boring bar optically compared to an exact contour. Speed and feed also contribute to precision. Another pass is made with a honing tool to break down the projecting peaks, and the result is an oil-retaining surface.

Unlike the usual inventive engineer, Harold Warner is known to his associates as a "clean desk" man, one who cheerfully puts up with the committee and paperwork routine inherent in any organization as large as GM. His steady-paced day runs from 7:40 am to around 6 o'clock at night.

As he leaves the plant each night, Warner picks a new Cadillac at random off the assembly line for the half-hour drive to his home in suburban Birmingham, Mich. Woe betide the superintendent who has missed a loose screw or squeak.

Warner has yet to fall into today's pattern of spending almost as much time on civic affairs as on the job, although he is active in his church, and in the Society of Automotive Engineers (he once chaired a national production meeting).

Associates describe Harold Warner as warm and friendly. He can tell a good story, and isn't averse to an occasional party. But unlike one of his recent predecessors, no one has ever heard him use a colorful adjective. Nor has anyone ever seen him pound a table.

He prefers to spend his leisure time with his wife and teen age daughter, and on his hobbies. These include photography, reproducing Duncan Phyfe furniture so well that it takes an expert to tell it from the original, and growing roses. The latter hobby poses somewhat of a problem—unfortunately, one of the most desirable varieties is named the Chrysler Imperial. •

E W Bliss Co has appointed **Marquis P Orr** general sales manager of the **Mackintosh-Hemphill Division** in Midland and Pittsburgh. He was formerly manager of roll sales.

International Radiant Corp, New York manufacturer of environmental test equipment, has named **Charles E Swanson** production manager. Prior to joining the company Mr Swanson was associated with **Roy Engineering & Iron Works** as production manager.

Electric Autolite Co, Toledo, has named Vice President **Lawrence L Garbe** to the post of group executive, directing the operations of three divisions—automotive and aircraft batteries in the US and Canada, industrial batteries, and wire and cable.

Cincinnati Milling Products Division of Cincinnati Milling Machine Co has appointed **George E Parker** assistant sales manager. **Charles E Reichel,** sales representative, has been named Chicago district sales manager to succeed Mr Parker.

Dana Corp, Toledo, has appointed **Norman W Kimmel** to the corporate manufacturing staff as director of purchasing and production control. Mr Kimmel has been plant manager of the company's Fort Wayne, Ind, division since 1953.

Skinner Precision Industries Inc, New Britain, Conn, has appointed **Paul Erik Dillberg** sales manager of the company's **Skinner - Horton Chuck Division.** He succeeds **Kenneth W Walther** who, after 40 years with the company, will continue as secretary and sales consultant. Mr Dillberg has been associated with the chuck industry for over 20 years in various engineering, production, and sales activities.

Kennametal Inc, Latrobe, Pa, has appointed **James B Andersen** manager of Kendex Tooling sales with headquarters in Willoughby, Ohio. He has been associated with the firm for 12 years and has been most recently serving as field supervisor in the Detroit sales district.

Crown Cork & Seal Co, Philadelphia, has elected **John J Luviano** vice president of the Machinery Division.

Young Spring & Wire Corp, Los Angeles, has appointed **Robert E Parrett** corporate director of manufacturing. Mr Parrett was formerly vice president and director of manufacturing for American Hardware Corp, New Britain, Conn.

Sperry Products Co, a division of **Howe Sound Co,** has appointed **Robert C Main** manager of engineering. Before joining Sperry Mr Main was associated with United Aircraft as engineering manager of the Missiles and Space Systems Division.

Lipe-Rollway Corp has named **Hugo C Klix** sales manager of the **Bar Feed Division** to succeed **Bernard C Harney** who has retired. Mr Klix who has been in charge of machine tool sales since 1959 will continue to handle the subcontract work for machine tool sales in addition to his new duties.

Ford Motor Co has appointed **Denis J Bracken** general manager of the newly set up Automotive Assembly Division composed of 17 assembly plants formerly operated by Ford Division. Mr Bracken has been general manufacturing manager of Ford Division

Besly-Welles Corp, Chicago and South Beloit, Ill, has elected **Jack T Le Beau** vice president in charge of the Abrasives Division. A member of the firm for 24 years, Mr Le Beau replaces **Norman C Minehart** who has retired after 38 years of service

Detroit Tooling Association has elected **George Tann** president of the organization. Mr Tann is vice president of **Congress Tool & Die Division, Tann Corp.** New vice president of DTA is **Howard N Maynard,** president of **Snyder Corp**

United-Greenfield Corp, Chicago manufacturer of metal cutting and threading tools, has elected **Edwin W Zipse** president. Now executive vice president, he will take office Jan 1 succeeding **Konstantin Kronwall** who is resigning because of ill health. **Jack C Malugen,** president of **J H Williams & Co,** a division, will replace Mr Zipse.

Chrysler Corp has appointed **Walter B Connolly** general plants manager for the Stamping Group. Previously he was plant manager for the group's Mack Avenue Stamping operations in Detroit.

Brubaker Tool Corp, Millersburg, Pa, has named **John W Dowding** to head the manufacturing operation. Mr Dowding will combine his responsibilities as vice president of engineering with those of directing the manufacturing operation.

Borg-Warner Corp, Chicago, has appointed **John W Holdeman** vice president, engineering, of the Warner Automotive Division at Auburn, Ind. He has most recently been serving as associate director, Automotive Department at the Roy C Ingersoll Research Center of Borg-Warner.

American-Standard Industrial Division, Dearborn, Mich, has appointed **Emil F Peslar** vice president, manufacturing, to replace **R S Reade** who has resigned. Before joining the company Mr Peslar was vice president, York Division of Borg-Warner.

Bendix Corp has appointed **David H Brown** general manager of the Bendix-Pacific Division, North Hollywood, Calif, organization engaged in electronic, hydraulic, and sonar research, development, and production. Mr Brown, assistant general manager of the division since 1955, succeeds **R C Fuller,** vice president and group executive.

Dow Chemical Co, Midland, Mich, has named **Herbert D Doan** executive vice president to succeed **Dr Mark E Putnam** who died Nov 6. Mr Doan was formerly manager of the Chemicals Department. **John M Henske,** manager of product services for the Midland Division, replaces Mr Doan.

Fort Steuben Metal Products Co, Weirton, W Va, has appointed **Alvin Curtis Amos Jr** production manager.

Fafnir Bearing Co, New Britain, Conn, has elected **Keith T Middleton** executive vice president. Mr Middleton was formerly administrative vice president

Packard Bell Electronics, Los Angeles, has announced that **Hans M Schiff** has joined the firm as vice president and general manager of the Technical Products Division to succeed **Richard B Leng** who earlier this year was named group vice president of the Defense and Industrial Group. For the past two years Mr Schiff has been associated with Ryan Aeronautical Co, Torrance, Calif, as operations manager of the Electronics Division.

Electro-Tec Corp, South Hackensack, NJ, manufacturer of electronic and electromechanical devices has elected **Robert S Kinsey** and **Vernon L Haag** vice presidents. Mr Kinsey is director of engineering and Mr Haag director of manufacturing.

Garrett Corp has appointed **Robert L Daniels** manager of the **Marwedel Division,** San Francisco industrial tool and equipment supply house. Formerly director of industrial supply operations for Garrett in Los Angeles, Mr Daniels suceeds **Dwight Carroll** who has resigned.

Bunting Brass & Bronze Co, manufacturer of cast bronze bearings and sintered metal products, has elected **Raymond O Oyler** vice president. He will continue to direct company sales.

Thiokol Chemical Corp has appointed **Serenus H A Young** general manager of the Hunter-Bristol Division, Bristol, Pa. He was formerly head of the research and engineering program at the Quenhanna Plant of Curtiss Wright Corp. •

Part: Socket
Screw Stock: ½-in. BETH-LED round
Chip Removal: 79 per cent
Cutting Speed: 290 SFM—up 62 per cent*
Production Rate: 585 pieces/hr (net)—up 22 per cent*
Tool Life: increased by 20 to 35 per cent*

*over the control stock: C1213 non-leaded steel

Could you produce this part as fast?

...You could with BETH LED

It's Bethlehem's newest free-machining steel—a high-sulfur, leaded carbon screw stock that speeds metal removal. Lengthens tool life, too. And it machines to a satin-smooth finish.

Available through non-integrated cold-drawers

Plan now to cut *your* production costs with Beth-Led. It's readily available . . . cold-finished as distributed by non-integrated cold drawers . . . or hot-rolled, as produced by Bethlehem.

Steel
for Strength
. . . Economy
. . . Versatility

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Sales: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

CIRCLE 341 READER SERVICE CARD

General Grid Announces Honeycomb Core Material Said Stronger in All Dimensions

Trussgrid, a new honeycomb core material said to have an unusual combination on high strength, and dimensional stability, is fabricated of aluminum foil supplied in alloy 5052 by Alcoa. The material, made by General Grid Corp, is said to make possible sandwich panels that are stronger in all dimensions than conventional honeycomb-core panels.

Because corrugations of each foil layer form a 90° angle with those of its neighbor, channels in alternate layers of foil run in the same direction; this gives strength and rigidity in three planes. This cross-lamination design enables Trussgrid to perfrom well in both light and heavy load-bearing applications.

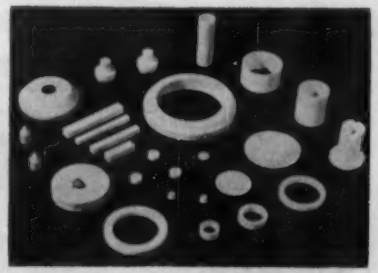
On an equal weight basis, the material resists 25 times more crushing force—applied perpendicular to the cell axis—than conventional hexagonal honeycomb core. This makes it desirable for use where load application cannot be controlled.

The material can be shaped readily by roll-forming and by crushing; it has excellent machining characteristics. In fact, cell reinforcement for efficient machining is not required.

Trussgrid's natural venting characteristics promote bonding with all types of adhesives, without perforating cell walls for the escape of gases. Also, the open construction of the material which is available in a number of standard sizes, makes it readily adaptable to internal fuel storage.

General Grid Corp, Army Chemical Center, Edgewood, Md

MORE DATA? Circle 51, inside back cover



Ceramic Product Line Gives Heat Resistance to 3000 F

Duramic HT-1 line of ceramic products, which have heat resistance to 3000 F, also gives hardness in the range of carbides, and dielectric strength as high as 250 volts per mil. The high aluminum oxide ceramics are available in three grades:

- HT-1-A—Best for high wear, with moderate heat shock;
- HT-1-B — Best for moderate wear, with high heat shock;
- HT-1-C—Best for extreme wear, with moderate heat shock.

Parts in the series of alumina ceramics, which have compressive strengths to 400,000 psi, are available in diameters to 10.00 in. Standard size tolerances are as close as ±0.005 in. as fired, and parts can be ground to ±0.0001 in. The parts can be metalized for soft or hard soldering, or they can be fastened with ceramic and epoxy cements.

Duramic Products, Inc, 426 Commercial Ave, Palisades Park, NJ

MORE DATA? Circle 55, inside back cover

99.5% Aluminum Oxide Ceramic Works at Temperatures to 3200 F

Coors type AD-995, is a vacuum-tight, high strength 99.5% aluminum oxide ceramic which has a maximum working temperature to 3200 F when properly supported. It maintains flexural strength of 28,900 psi at 2000 F and 15,300 psi at 2500 F.

This dense material has a specific gravity of 3.8, and is one of the hardest synthetic materials known. It rates 9 on Moh's scale and 80 on Rockwell 45 N scale.

Because it has such a high aluminum oxide content, and no silica, the AD-995 has a particularly high resistance to corrosion even at elevated temperatures. It has ultra-low dielectric loss characteristics.

Coors Porcelain Co, 600 Ninth St, Golden, Col

MORE DATA? Circle 52, inside back cover

Three Spray Products Said to Aid Machine Shops Many Ways

Three new spray products for machine shops are said to save make-ready and clean-up time, permit higher finish quality, and smooth out production snags. Micro-Finish is a new slow-evaporating cutting liquid for close tolerance machining operations and for threading, tapping, and form-cutting applications with difficult metals. It is designed to improve tool life and finish.

Anti-Rust coats metal surfaces with a water-displacing film which eliminates dipping of production metal and gives rust corrosion protection to machinery and tools.

The problem of removing metal spatters after welding operations is simplified by Spatagon. Spatters wipe off easily when Spatagon is sprayed first, because the protective surface film it forms prevents spatters from adhering to metal. No preliminary surface cleaning is required, and the film may be painted over.

Pacific Petrochemical Co, Inc, Box 107, 5161 Triggs, Los Angeles 22, Calif

MORE DATA? Circle 53, inside back cover

Ink Works for Printed Circuits

A new conductive ink for printed circuits is said to be a smooth, heavy bodied conductive black ink that screens sharply, dries in ½ to ¾ hr, and adheres to a wide variety of materials. When deposited by screen process through an 8xx mesh, a conductivity rating of 3000 to 5000 ohms per inch can be anticipated.

Advance Process Supply Co, Inc, 2315 W Huron St, Chicago 12, Ill

MORE DATA? Circle 54, inside back cover

Solid Film Lubricant Can Be Washed Off Parts in Warm Water

Solid film lubricant 22-T, which is designed for metal spinning, die stamping and forming, tube bending, and wire drawing, is easily applied either by dipping or spraying, and can be washed off the finished part in 140 F water. Its low coefficient of friction allows smaller radius bends on tubing.

On unheated spinning parts friction temperatures dropped from the 125 to 155 F range to within the 85 to 105 F range where commercial colloidal graphite suspension was replaced with this lubricant.

Electrofilm, Inc 7116 Laurel Canyon Blvd, N Hollywood, Calif

MORE DATA? Circle 56, inside back cover

YOU CAN INCREASE PROFIT AND PRODUCTION

with this new POPE 10-6 SUPER-PRECISION BORING MACHINE

Two Heads Are Better Than One

and of course you can have more than one spindle in each head. The Pope Model 10-6 features *two precision boring heads** operating completely independently of each other to provide simultaneous or alternate cycling movement of the heads. *This means increased production.*

*The Pope Boring Head Spindles on this machine revolve within 20 Millionths.

Do It All With Dials

Automatic cycles for boring operation sequences are programmed on these dials. The operator simply determines the sequence of operations and dials each one. You get continuous production of uniform parts in less time.

The Pope Electric Programmer gives you finger-tip fast control of infinitely variable speed, distance and operating sequence. You dial in the complete program with ease and speed that beats expensive numerical or tape control. Constant accuracy is maintained for cycle after cycle.

- Table dimensions — 12" x 12"
- Maximum stroke, each head — 6"
- Standard center height — 5½" (variable)

No. 132

For *precision production at a profit* look into this Pope Model 10-6. Write for Bulletin S-21.

POPE®

ENGINEERS, DESIGNS AND BUILDS PRECISION ANTI-FRICTION BEARING SPINDLES FOR EVERY PURPOSE

POPE MACHINERY CORPORATION • 261 RIVER STREET • HAVERHILL, MASS.

Established 1920

Newcomer Products Announces 5 Grades of Cemented Carbides

Five newly developed grades of cemented carbides, called NewBide, have Rockwell (A) hardness ranging from 91.2 to 93.0, and transverse rupture strengths from 225,000 to 325,000 psi. The series contains:

- N-20—a fine grain, high tensile general purpose grade for machining cast iron and non-ferrous materials. It has added crater resistance for the alloy types of cast iron.
- N-50—recommended for heavy cuts on steel and as a premium general purpose grade.
- N-60—specially designed for general purpose machining of steel under normal conditions. It has less shock resistance, but greater wear resistance than N-50.
- N-70—general purpose finishing grade for moderate cuts at relatively high speeds.
- N-80—a premium high speed finishing and precision boring grade.

Newcomer Products, Inc, Latrobe, Pa

MORE DATA? Circle 57, inside back cover

Metal Strip Available With Tolerances to Ten-Thousandths

Ferrous and non-ferrous metal strip, developed in response to requirements for production of sub-micro precision parts, is now available with tolerances to 0.0001 in. The accuracy of this rolled metal is said to eliminate the need for precision grinding and lapping operations and to minimize dimensional rejects.

Known as ultra-micro precision strip and shim stock, it is available in brass, steel, aluminum, titanium, stainless, and other metals in thicknesses from 0.0005 to 0.125 in. and in widths up to 6 in.

In strip gages it can be used where precision parts are to be stamped or formed from strip; in shim gages, it can provide precision tolerances for forgings or castings that were previously machined only to commercial tolerances.

American Silver Co, Inc, 36-04 Prince St, Flushing 54, NY

MORE DATA? Circle 58, inside back cover

Alloy Made for Anti-Smog Devices

New alloy steel, priced less than other materials being evaluated, is designed to meet California's requirements for use in automobile anti-smog devices. The alloy is nominally 21% chromium, 6% nickel, and 9% manganese. Price base is 72.25¢ per lb for sheets and cold rolled strip.

Armco Steel Corp, Middletown, Ohio

MORE DATA? Circle 59, inside back cover

Composite Tubing Gives Better Results in Nuclear Reactors

New composite tubing, which is a marriage of stainless and carbon steel, is produced by a method which combines the Ulam Process for cladding metals and a hot extrusion process for transforming billets to tubing. This material for nuclear reactors gives advantages of both the steels which it contains.

The stainless interior, which carries the medium used to cool a reactor's fuel system, is used because of its corrosion resistant qualities. The carbon steel on the exterior permits a strong weld of the tubing to the reactor structure.

Also, the corrosion resistance of the composite tubing, which is being produced for Standard Pressed Steel Co of Jenkintown, Pa, is increased by cathodic-type protection resulting from the metal combination. The metallurgical bond eliminates any possibility of a corrosive medium seeping between the liner and the outside carbon steel.

Allegheny Ludlum Steel Corp, Oliver Bldg, Pittsburgh 22, Pa

MORE DATA? Circle 60, inside back cover

Fluid Gives Better Results On Most Precision Operations

Dual-Action cutting fluids, originally compounded to answer the need for better tapping results, have proven equally effective on all other precision operations such as reaming, parting, threading, and finishing. Improved finish, longer tool life, freedom from tool seizure and galling, freer cutting action, reduced fluid cost, and increased production are claimed.

The new fluid combines both chilling and lubricating in a controlled time-cycle. Fluids stay on the tool long enough to do a job, yet leave no messy clean-up job.

Dual-Action cutting fluid No. 1 is especially compounded for use on steel and all other metals except aluminum; No. 2 is for use on aluminum exclusively. Neither fluid contains carbon tetrachloride and both are non-toxic.

Tapmatic Corp, 845 W 16th St, Costa Mesa, Calif

MORE DATA? Circle 61, inside back cover

Solder Foil Comes in Wide Range of Alloys, Melting Points

Expanded line of solder foil alloys includes over 50 different alloys with melting points that vary from 100 C up to 400 C. The foil is available in widths up to 6-in. maximum and in thicknesses down to 0.0005 in. with tolerances as close as ±0.0001 in.

The company maintains complete "vertical" facilities for foil production: they melt, analyze, and document their own alloys.

Accurate Specialties Co, Inc, 340 Hudson St, Hackensack, NJ

MORE DATA? Circle 62, inside back cover

Surf-Kote Lubricant Designed For High Temp, Pressure Work

Surf-Kote L-1020, which is a new lubricant for high-temperature high-pressure applications, contains a modified molybdenum disulfide compound and other additives suspended in a synthetic base vehicle. When this base evaporates, it leaves a durable dry film of lubricating compound on most metal surfaces, prevents galling, seizing, fretting corrosion, and cold welding.

The non-inflammable lubricant is specifically formulated for use under high-pressure conditions up to 750 F. Unlike petroleum base lubricants, it will not deteriorate or form carbonaceous deposits when lubricating kiln car wheels, conveyor bearings, furnace hinge pins, and similar equipment.

It can be applied directly to load bearing surfaces or through grease cups and zerk fittings with hand oilers, an oil can, or by brushing.

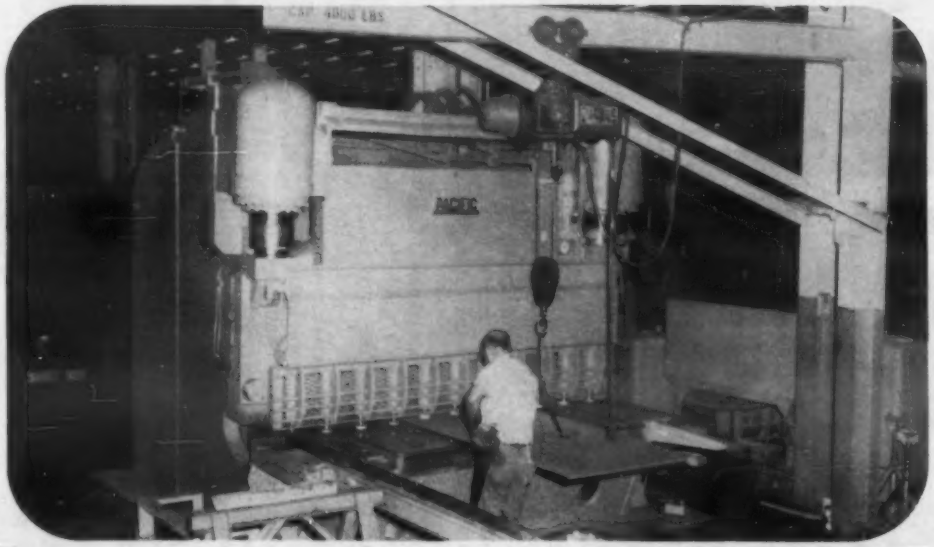
Hohman Plating & Mfg Co, 814 Vermont Ave, Dayton 4, Ohio •

MORE DATA? Circle 63, inside back cover

CUT CONTROL ENABLES PACIFIC HYDRAULIC SHEAR TO DO JOBS IMPOSSIBLE ON ANY OTHER SHEAR!

PACIFIC *Cut Control* is a group of adjustments permitting all controls to be set at the optimum value for perfect shearing of each different job: light gauge, heavy plate, polished stainless, soft aluminum, brittle alloys, long narrow strips, high speed cycling for high production, extreme accuracy for precision work. Unlike conventional shears limited in shearing ability by permanent settings without possible adjustment, PACIFIC can be controlled to fit the job exactly. No longer is it necessary to compromise with quality because the shear cannot be adjusted.

- **Adjustable holddowns** eliminate marking of soft polished sheets.
- **Holddowns move down independently of knife** to insure exact alignment of plate before cutting.
- **Adjustable knife clearance** for light gauge shearing with heavy plate shear. Eliminates rough secondary shear fracture in heavy shearing.
- **Rake angle adjustment** for minimum twist or bow in cutting narrow strips.
- **Cushioned shearing** plus rake angle adjustment enable brittle alloys to be cut.
- **Depth of stroke** readily adjustable for slitting.
- **Adjustable cycling speed** so machine speed can be set to match operator's ability to feed plate.
- **Non-wedging back gauge lift** to prevent wedging of narrow strips being cut.
- **Rapid, precision powered back gauges.**



Heavy plate shear cuts light material with minimum bow and twist

Adjustable rake angle enables a single PACIFIC hydraulic shear to cut both heavy plate and narrow strips of light gauge material with minimum bow and twist at Caterpillar Tractor Co., Joliet, Illinois. By a simple 1-minute adjustment, the rake of this massive 1½" shear can be set to the most efficient cutting angle for any thickness of material. With similarly rapid adjustment of the knife clearance, this largest adjustable rake shear ever built cuts a complete range of metals from light sheet to 1" plate to an accuracy of .030" over the entire 10 ft. bed length. Shorter pieces over 1" thick are cut to .125" accuracy. Shockless, hydraulic pressure extends knife life and permits operation of shear on ordinary, low cost concrete pads.

Heavy duty shear for continuous mill type service

Safe—the only shear that can be stopped instantly in emergency and is protected against overload

3 to 8 times longer knife life than mechanical shears

Noiseless operation—quieter than a sewing machine

Insignificant maintenance—all moving parts run in filtered oil and are protected against overload

Hundreds of dollars saved in foundation cost

Proven design—over 100 PACIFIC Shears in operation up to 5 years.

PACIFIC PRESSES AND SHEARS

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Induction Heat Treating Machine Has 2 Frequency Ranges; Output up to 50 KW

This single 50 KW machine—which was built for (and in conjunction with) Bennett Heat Treating Co, Inc, of Newark, NJ—combines capabilities that engineers had here-to-fore thought impossible in induction heat treating. It has interchangeable high and low frequency ranges: one from 200 to 450 kilocycles, and the other from 5 to 10 megacycles. Because of this, a job shop heat treating plant can select the precise frequency range best suited to any type of work. In addition, parts will have less deformation and surface scale because they are heated faster and with much less penetration.

When thin cross-sections were heated in the high megacycle range, the hardness pattern followed the contour of the gear teeth from face to root, and appeared similar to those produced by conventional case-hardening methods. Unlike the conventional methods, however, only the surface was heated by this frequency; therefore, practically no change in gear dimensions occurred.

Because heating cycles were shorter than anticipated, a heat timer with 1/100-sec sensitivity was needed. In the case of extremely fine-tooth gears, the hardening temperature was reached in only one-fifth second. This heating uniformity assured uniform hardness, and gears were handled on a production run basis at 7½ million cycles in complete safety.

During tests, it was found that the same equipment could harden, braze, or anneal high precision as well as standard-sized parts like gears, cams, shafts, or any other items that might require selective hardening operations.

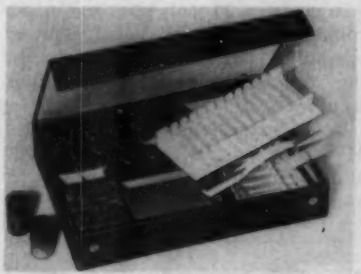
When straight-run standards were processed at a frequency of about 300 kc, quenching was often not necessary. For example, the rapid heating of gears brings them to full hardness so swiftly that no oil or water quench is needed. Only the surface is heated, and the remaining unheated metal causes the parts to chill so rapidly that they become self-quenching. This phenomenon should prove extremely useful when hardening certain types of parts that require their ultra-precise dimensions be held throughout the heat treatment.

Nevertheless, the work stations of the machine are equipped for automatic spray or drop quenching of the work by water, oil emulsion, or oil. Quenching qualities remain constant because the temperature of the oil emulsion and oil used for quenching is controlled by a combination heating-and-cooling heat exchanger.

Other important features: a revolving fixture (work platform) insures uniform penetration of heat from all sides; a variable ratio output transformer gives greater control of narrowband selective heating at high efficiency; transformers are controlled automatically to guard against voltage variations; the unit is air conditioned by means of a water-air heat exchanger so that all parts operate under constant conditions and condensation cannot occur to interfere with operations.

Induction Heating Corp, Brooklyn, NY

MORE DATA? Circle 64, inside back cover



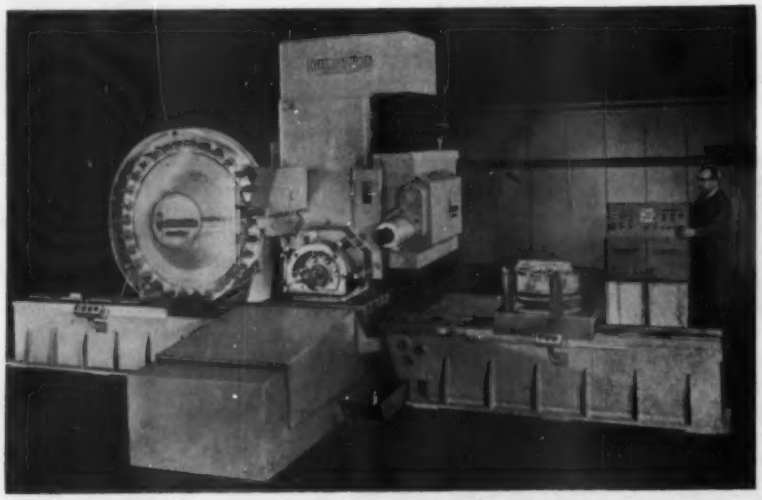
Talysurf Replica Kit Allows Check of Inaccessible Surfaces

This new kit accurately reproduces surface finishes for inspection on a Talysurf or interferometer. Neatly packaged in a compartmented case, the kit contains 24 jars of powder with 24 glass ampules of mixing liquid. Accessories include a container of solvent, a block of Plasticine, a steel file, and mixing sticks.

The accuracy of this method has been demonstrated by critical comparisons of surfaces and corresponding replicas of such materials as glass optical flats, stainless and tool steel, titanium, copper, and brass; processing has included examples of polishing, milling, grinding, and turning.

Dist by Engis Equipment Co, Div of Engineering and Scientific Instrumentation, 431 S Dearborn St, Chicago 5, Ill

MORE DATA? Circle 65, inside back cover



K&T Announces Milwaukee-Matic Model III With 30 Tools, 6-in. Dia Tool Capacity

Built on the same principles as the Model II, this numerically-controlled manufacturing center—which unifies milling, drilling, boring, reaming, tapping, and related operations—has a capacity of 30 tools plus one in the spindle and can make changes in 15 seconds. Maximum tool diameter in the Milwaukee-Matic Model III is 6 in.

Total spindle movement includes 44 inches in the longitudinal (X) axis, 34 inches in the vertical (Y) axis, and 32 inches in depth (Z) axis. A 14 hp spindle drive motor provides power to three speed ranges of 50 to 2000 rpm in 10 rpm increments; feed rates range from ½ to 29 ipm in ½ ipm increments. The rapid traverse rate is 150 ipm.

Workpiece pallets are automatically transferred to and from the rotary table — which automatically indexes 360° in 1° increments—on pallet shuttles.

Kearney & Trecker Corp, 6800 W National Ave, Milwaukee 14, Wis

MORE DATA? Circle 66, inside back cover

Electrical Senser Stops Machine If Workpiece is Oversize

Damage resulting from oversize workpieces in automatic as well as standard machine tools can be prevented by a sensing device developed by Michigan Tool. The attachment permits setting one pointer on a meter to the maximum load allowed by the setup; a second pointer on the meter indicates the actual load resulting from stock on the blank. If the load equals or is greater than the preset limit, the device automatically interrupts the machining cycle; it also signals that something is wrong.

Sensing mechanism operates by continuously checking the armature current being drawn by the cutter-drive motor. This technique is sufficiently sensitive to register stock variations in thousandths.

Michigan Tool Co, 7171 E McNichols Rd, Detroit 12, Mich

MORE DATA? Circle 67, inside back cover

Position Transducer Developed For Machine Tool Automation

This new position transducer, which was developed for machine tool automation systems, uses non-contact magnetic sensing heads which improve reliability and avoid the wear associated with more conventional code discs or other contact pick-ups. The design is also said to save space.

The sensing elements are magnetic heads that detect rotation of the shaft by an impedance change in the head. In typical applications, the unit detects 0.0001-in. increments at position speeds up to 120 ipm, or 0.001-in. increments at speeds of 200 ipm.

The transducer, without electronics, is priced at $295.

Rheem Electronics, Div of Rheem Mfg Co, 5200 W 104th St, Los Angeles, Calif

MORE DATA? Circle 68, inside back cover

Double Carbide Bandsaw Blade Cuts 50% Faster Than Carbon Bands

Called Starrett Alloy Band, this double carbide special alloy blade has improved hot hardness and abrasion resistance which permits using higher speeds and heavier feeds on standard bandsaw machines. Range of materials that can be cut with the band is extended to include many of the tougher alloy steels so that the need for expensive special cutoff equipment is frequently eliminated.

L S Starrett Co, Athol, Mass

MORE DATA? Circle 69, inside back cover

Non-Destructive Thickness Tester Gages Coatings on Iron and Steel

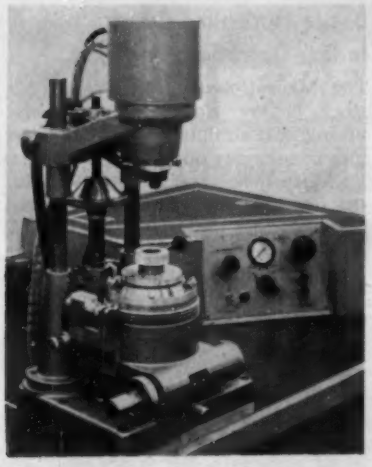
Type ES Permascope provides a non-destructive means of measuring thicknesses of organic and no-magnetic metal coatings (including phosphate) with the accuracy of the microscopic method, according to the manufacturer. It is reported to be particularly suited for testing coating thicknesses on piston rings, thin wire, screws, nut, pipes, and cylindrical containers as well as for gaging the thickness of foil or sheets made of non-ferrous materials.

The portable unit which measures 5¼ x 8¾ x 5 in. can be used wher-

ever a 110-v ac outlet is available. It incorporates a small 2-pole probe which works on the principle of a magnetic amplifier. Four probes are available with distances between poles of 5/32, ½, ⅝, and 1 in. for measuring thicknesses up to ¾ in.

Twin City Testing Corp, 533 S Niagara St, Tonawanda, NY

MORE DATA? Circle 70, inside back cover



Special Resistance Spotwelder Can Handle Very Thin Material

This new resistance spotwelder, which makes overlapping spots in a circular pattern, can weld stainless steel, Monel, and other materials as thin as one mill. These machines, with a uniquely designed welding head, are currently being used to produce a hermetic seal weld between a thin diaphragm and frame of pressure transducers.

With proper power supply, the welding unit is capable of from 0 to 300 spots a min, overlapping for hermetic seal. Welding pressure can be adjusted to 60 lb.

Statham Instruments, Inc, 12401 W Olympic Blvd, Los Angeles 64, Calif

MORE DATA? Circle 71, inside back cover

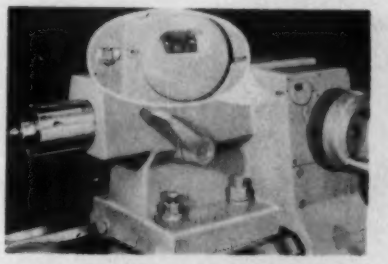
Single Turn Rotary Trimmer Operates Under Severe Conditions

This ½-in.-diameter trimmer, known as Type 5001, is available with bushing or servo mounting and is capable of withstanding in excess of 150 G shock and 15 G vibration. Power rating is 2 w at 60 C and standard resistance is 10 ohms to 20 K with higher resistance to 150 K available on special order. All electrical connections are welded and all moving contacts are of solid precious metal.

Solid metal case has molded-in rear terminals or leads as well as an O-ring shaft seal. Resistance tolerance is ± 5% and linearity tolerance ± 3%.

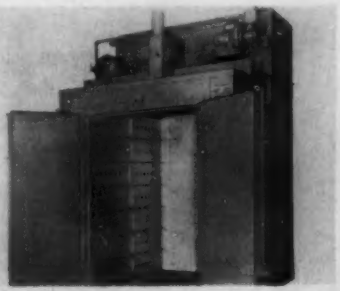
International Resistance Co, 401 N Broad St, Philadelphia 8, Pa

MORE DATA? Circle 72, inside back cover



DIRECT READING, digital traverse dial counter, a zero setting device, automatically shows movement and setting of tailstock spindle of precision lathe in 1/100 in. This eliminates calculations and possibility of mistakes—*Durant Mfg Co, Milwaukee, Wis*

MORE DATA? Circle 73, inside back cover



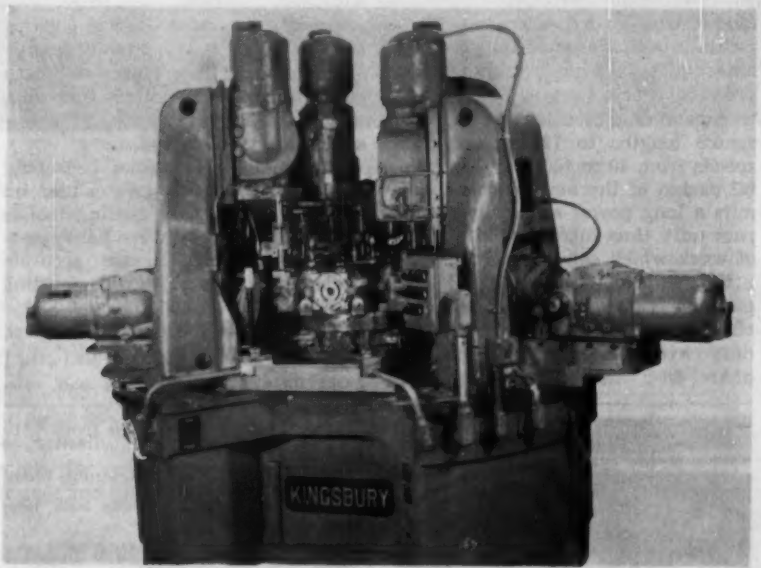
Batch-Type Production Ovens Assembled From Stock Components

Delivered either assembled or ready for assembly, these ovens are easy to install and can utilize steam, gas, or electric heat. Applications include baking various types of finishes, preheating, drying, and similar work.

Loading is accomplished by means of stationary racks, trays, trucks, or hand-operated monorail conveyors.

DeVilbiss Co, Toledo, Ohio

MORE DATA? Circle 74, inside back cover



Kingsbury Multi-Unit Automatic Machines Die Cast Aluminum Oil Pump Housings

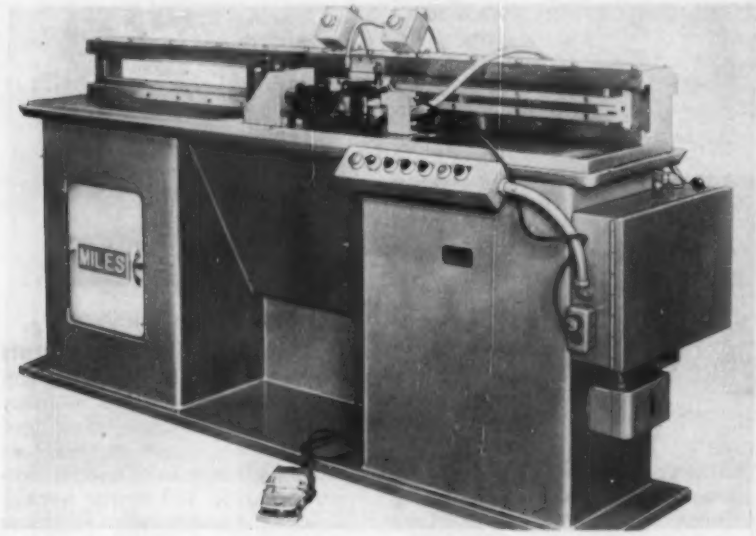
A 20-in. index table holds seven work fixtures while nine spindles of this multi-unit automatic mill a recess, spotface, drill, countersink, and ream at a gross rate of 460 parts an hour. Each fixture holds one housing at a time with its axis horizontal and the hub in.

When the operator turns the handle, a cam actuates two jaws that clamp the work against a finished surface. Rotative location is by a pin that enters one of the cast holes.

Four vertical units spotface a flat on the hub and drill and countersink two holes; one horizontal unit is mounted on a dovetail adapter that swivels the spindle up for milling a recess in the ID of the hub; two more horizontal units drill and ream two of the holes in the face.

Kingsbury Machine Tool Corp, Keene, NH

MORE DATA? Circle 75, inside back cover



Horizontal Broaching Machine Handles Both Production and Short Run Jobs

Moderately priced universal horizontal broach, designed for precision external or internal broaching on a production or short run basis, comes in capacities of 1, 2, or 3 tons, with stroke lengths to 72 in., and ram speeds from 40 to 100 fpm. Horizontal design of the new machine permits a long power stroke in a compact unit, thus increasing the range of work which can be handled.

Hydraulic power is supplied by a package power unit which is interchangeable and consists of a heavy duty hydraulic pump, 220/440 3-phase 60-c motor, pressure valve, solenoid - operated 4-way valve, speed control valve, and hydraulic fluid reservoir. The power unit is a complete, self-contained assembly which slides into the base of the machine to save floor space.

Extremely long stroke broaching is possible because the slide, on which the broach or cutting tool is mounted, moves between heavy-section ways which assure accurate horizontal passes during cutting stroke.

Ty Miles, Inc, Box 446 Elmhurst, Ill

MORE DATA? Circle 76, inside back cover

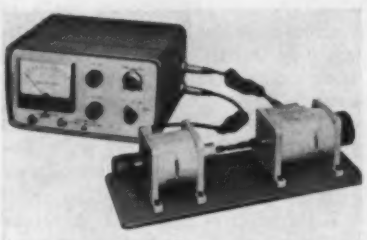
Device Marks and Counts In One Operation

The Mark-Counter for use on bar stock, boxes, forgings, stampings, tubing, and similar items counts and identifies in one operation. Each time a piece of material is touched with the pen tip, it leaves a small spot of ink, and the counter clicks once. The spot of ink identifies each item counted, and the counter dial shows the exact number of items identified.

Each kit is furnished with five different color pens. A different color can be used, for instance, at each inventory period. Pens can be replaced rapidly so that different colors can be used for different grades or classes of materials. Kit is $28.50.

Van D Mark, PO Box 44, St Clair, Mich

MORE DATA? Circle 79, inside back cover



Gear Analyzer Measures Backlash Angle and Breakaway Torque

Because it applies torque alternately clockwise and counterclockwise, this gear analyzer permits direction observation of shaft backlash angle and permits detection of minute shaft motion while determining breakaway torque. An amber light indicates when the desired backlash torque has been applied, and a red light indicates when the allowable breakaway torque has been exceeded.

A double collet sliding coupling transmits the backlash and breakaway torques which may be preset to any desired values within the selected instrument ranges, extending from 0.002 to 48 oz-in.

Rotiform Co, 1509 Colorado Ave, Santa Monica, Calif

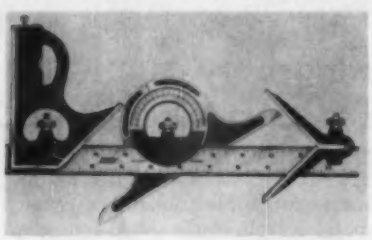
MORE DATA? Circle 80, inside back cover

Standard Stock Precision Gears Offered for Miniaturized Products

Fine pitch precision spur gears are available in a range of standard sizes from 48 to 120 DP, 10 to 40 teeth in stainless steel, and 42 to 180 teeth in aluminum. Each gear is certified to be AGMA Precision Class I or better. These gears range from 1/10 to 2¼ in. in OD.

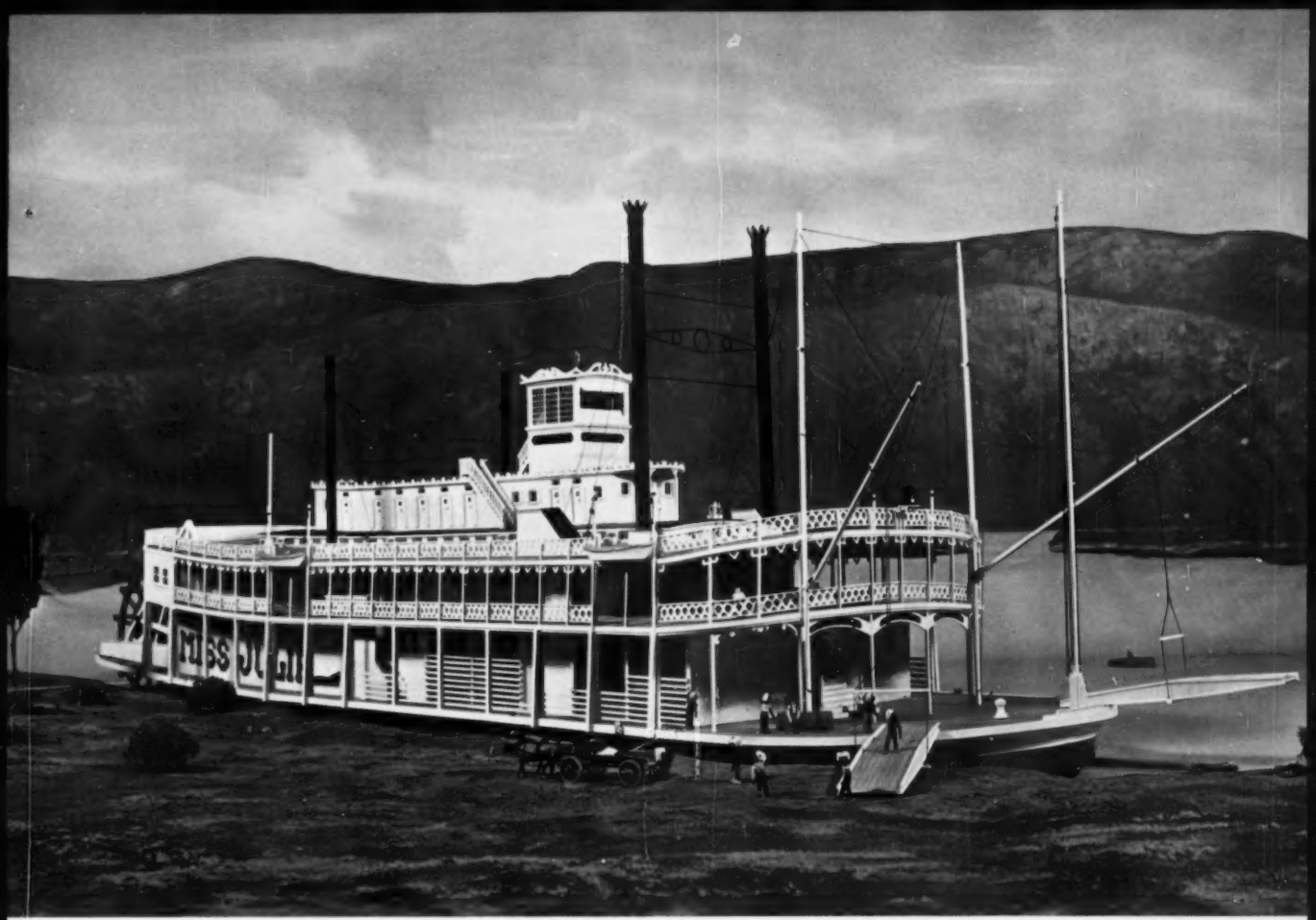
Boston Gear Works, Quincy, Mass

MORE DATA? Circle 77, inside back cover



COMBINATION SQUARE SETS now have chrome clad finish. No. C525-4R has cast square and center head; protractor is non-reversible. Blade, available in 12, 18, and 24-in. lengths, has No. 4 rapid reading graduations—*Lufkin Rule Co, Saginaw, Mich*

MORE DATA? Circle 78, inside back cover



OHIO Special Quality Tubing makes muscles that never tire

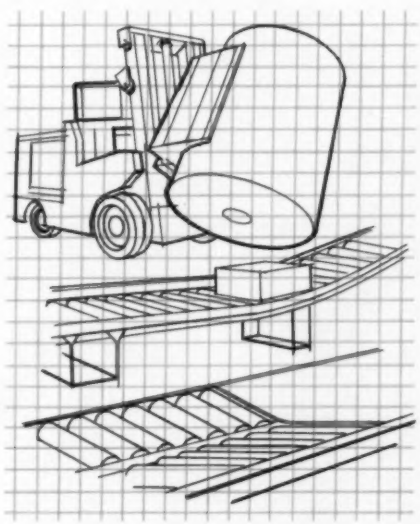
Strength, weight and cost advantages of OHIO Special Quality Tubing make it ideal for use in materials handling equipment — the modern lift trucks, belt and roller conveyor systems that provide the heft and muscle to move materials.

You can strengthen your product, too, if you weigh these important facts. OHIO Tubing is always the exact tubing you need because OHIO Tubing is CUSTOM MADE for your product. Your order is manufactured to your own specifications to produce steel tubing especially for your application — the precise grade, analysis, size, shape, special anneal and tolerances best suited to your needs.

Ohio Seamless Tube produces both seamless and electric welded steel tubing — is prepared to form many finished or semi-finished tubular parts to your designs.

To get the most from your next steel tubing order, specify OHIO Special Quality Tubing. Contact your nearest Ohio Seamless representative, or send part drawings to the plant at Shelby, Ohio — Birthplace of the Seamless Steel Tube Industry in America.

A-9281A



Model illustrated built to 3.5 mm scale.

OHIO

OHIO SEAMLESS TUBE

Division of Copperweld Steel Company • **SHELBY, OHIO**

Seamless and Electric Resistance Welded Steel Tubing • Fabricating and Forging

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CANADA: Railway & Power Engr. Corp., Ltd. EXPORT: Copperweld Steel International Company, 225 Broadway, New York 7, New York

FASTENOMICS

TIPS ON FASTENER APPLICATIONS BY STANSCREW

Bright or Heat-Treated Hex Cap Screws? Each can save you money

Bright and heat-treated hex cap screws (SAE Grade 5) are produced to the same dimensional specifications. Heat-treating, which results in a somewhat higher cost, gives superior hardness. The greatest difference is the higher tensile strength, as shown below.

HOW TENSILE STRENGTH COMPARES

Diameter Coarse Thread (UNC)	Bright Cap Screws Tensile Strength (Pounds)	Heat-Treated Cap Screws Tensile Strength (Pounds)
¼"	2,200	3,800
5/16"	3,600	6,300
3/8"	5,350	9,300
½"	9,800	17,050
5/8"	14,450	27,100
¾"	21,400	40,100

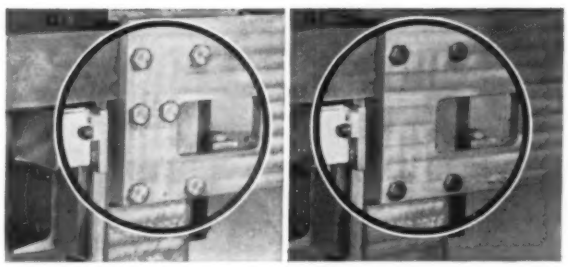
Pick The Right One

Selecting the right cap screw can mean substantial savings. For example, in the support plate assembly at right, six 3/8" bright cap screws were used. Investigation showed four 5/16" heat-treated cap screws could do the job more efficiently. By eliminating two fasteners and substituting a smaller size, total fastener costs were cut 37% . . . and important additional savings were made by reducing machining and assembly time.

The best answer for any application can be determined only after careful consideration of the advantages and disadvantages of both fasteners.

Bright Hex Cap Screw Advantages

1. In pure fatigue (no pre-stress on the fastener) the difference in fatigue strength between a bright and a heat-treated cap screw is not sufficient to offset the cost difference.
2. When bolting low strength materials, high clamping forces can cause the material under the bolt head to indent. Here the higher clamping force of the heat-treated screw offers no advantage.



Fastener costs were cut 37% when heat-treated cap screws were substituted for "brights" in this support plate.

3. In applications where joint rigidity requires a certain minimum number of fasteners, "brights" usually are the economical answer.
4. Greater availability from local sources simplifies field maintenance.

Heat-Treated Hex Cap Screw Advantages

1. In a rigid joint you get far more clamping force per dollar cost.
2. The shear strength per dollar cost is substantially higher.
3. When heads are exposed to abrasive conditions, heat-treated screws will sustain considerably less damage or wear.

Hold Inventories Down

Obviously, the best and cheapest screw for each job varies with the application. Unless you use a very large quantity of each grade, however, it is seldom wise to stock two grades of the same size and type of fastener, since this raises inventory costs. Normally the simplest and cheapest approach is to stock the stronger . . . or heat-treated . . . variety.

For Further Information

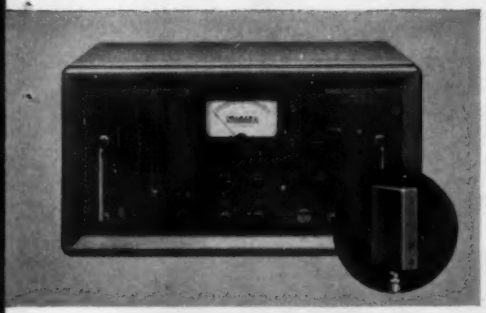
Our fastener specialists will be happy to give you further information or suggestions on specific applications. You can get in touch with them through your local Stanscrew distributor. He'll also be happy to supply you with any of Stanscrew's 5,500 different types and sizes of standard fasteners.

STANSCREW FASTENERS

CHICAGO | THE CHICAGO SCREW COMPANY, BELLWOOD, ILLINOIS
HMS | HARTFORD MACHINE SCREW COMPANY, HARTFORD, CONNECTICUT
WESTERN | THE WESTERN AUTOMATIC MACHINE SCREW COMPANY, ELYRIA, OHIO

STANDARD SCREW COMPANY 2701 Washington Boulevard, Bellwood, Illinois

NEW ADVANCEMENTS ON THE METAL FORMING FRONT



ELECTRONIC PRESS LOAD MONITOR ACTUATES SIGNAL OR DISENGAGES CLUTCH WHEN OVERLOAD OCCURS

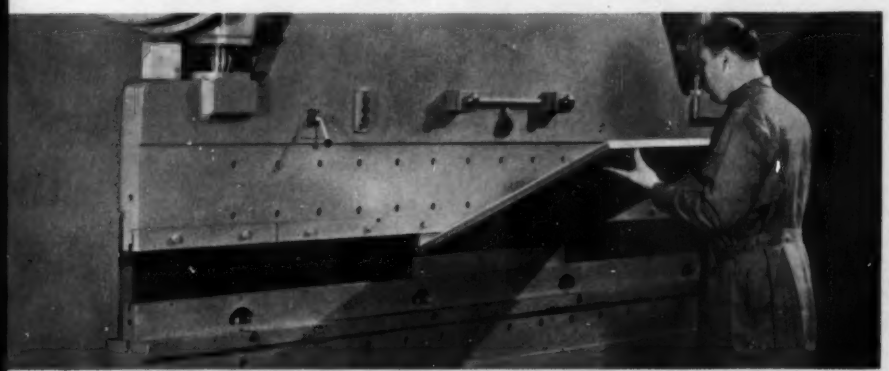
Niagara's new Press Load Monitor, an electronic precision instrument, continuously measures and visually indicates all loads on a press during die setup or production. When a preselected press load is reached, a tripping circuit disengages the clutch to prevent overload repeats, or actuates a warning signal. Consisting of 2 or 4 pickups mounted permanently to press frames or tie rods, and a control unit located near the press, Load Monitor instantly indicates press loads from 0 to 140% of press capacity regardless of press speed. Key-locked controls prevent tampering by unauthorized personnel. Request *Product Report No. 2.*

PORTABLE ELECTRONIC TONMETER MEASURES LOADS TO SAFEGUARD DIES AND PRESSES

The Niagara Portable Transistorized Tonmeter is an accurate, fast-response instrument for measuring loads imposed on a press or battery of presses during production or die setup. Pickups placed on press frames sense the intensity of loads. Large indicator, reading in percentage of press capacity, shows the maximum load during the press cycle. Because battery-powered unit requires no electrical outlet and is easy to carry, one individual can check several presses in minutes. Unit is designed to prove its calibration and test its own battery to be sure operating power is within prescribed limits. Request *Product Report No. 2.*

SLIDING BOLSTER PRESSES SLASH DIE CHANGEOVER TIME

Niagara presses arranged with Sliding Bolsters save hours of setup time on work requiring frequent die changes. On inclinables, straight sides, or other Niagara presses, sliding bolsters permit die removal or replacement in minutes instead of hours. Floating on a "cushion of air," dies can be easily moved into and out of work area by hand. Optional features for the slide may include power or manual die clamps, power or manual slide adjustment, shut height position indicator, semi-automatic slide positioner. Request *Product Report No. 1.*



AUTOMATIC STROKE CONTROLS PREVENT PRESS BRAKE "WHIP-UP"

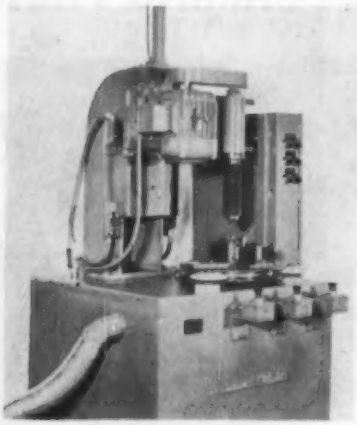
Two automatic stroke control systems recently developed by Niagara are making new press brake efficiency and operating safety a reality.

The first, an Alternating 2-Speed Stroke Control, for press brakes with air clutches, increases production by providing a positive means of avoiding "whip-up" and "back bending" during high speed operations involving wide sheets. Following a fast approach, ram speed is automatically reduced during the working portion of the stroke, then automatically increased for a fast return to top of stroke. Because slipping the clutch is no longer necessary, less operator skill and experience are required. Clutch burnouts are prevented. Work spoilage resulting from back bends is eliminated. Selector switch offers choice of three stroke-speed combinations. Request *Product Report No. 3.*

The second, an Automatic Ram Arrestor, is available for both air and mechanical clutch machines. Following a fast approach, ram is automatically *stopped* at a predetermined point just before it touches the work. Ram can then be "inched" through the bending portion of the stroke, avoiding whip-up and back bending. It may then be returned to top of stroke at high speed. Since inching is confined to such a small portion of the stroke, operating cycle is faster... operator fatigue and clutch wear are reduced. Even inexperienced operators can perform safely and efficiently with minimum work spoilage. A single adjustment permits the stopping point to be matched to die and material. Request *Product Report No. 3.*

NIAGARA

NIAGARA MACHINE & TOOL WORKS
683 Northland Avenue, Buffalo 11, N. Y.



Grinder/Polisher Finishes Interior of Cylindrical Parts

Internal surfaces of cylindrical parts can be deburred and polished with accuracy and uniformity with this special machine which features an abrasive sleeve mounted on an expandable rubber mandrel and an adjustable fixture for clamping the part which is mounted on a powered turntable.

Through a series of micro switches, the table rotates when the mandrel is lowered into position. Reciprocal motion of the mandrel permits the use of the full abrasive width, and produces a more uniform finish.

Grinding & Polishing Machinery Corp, 2530 Winthrop Ave, Indianapolis 5, Ind

MORE DATA? Circle 84, inside back cover

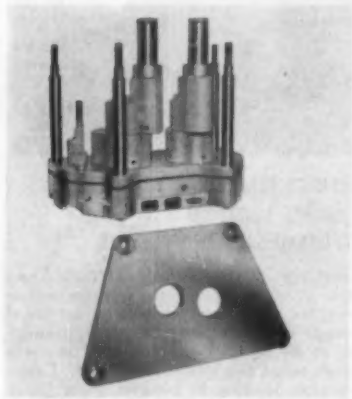
Vacuum Forming Machine Produces Quality Parts Around the Clock

Model V vacuum forming machine, for the plastic and packaging industry, can be fed manually for small runs or automatically for high production with roll and sheet feeders. The machine, which will operate around the clock, will do vacuum forming, vacuum drape forming, or drape plug assist forming; it has three positions for skin packaging.

Model V is available in the following standard mold sizes: 20 x 25 in., 24 x 34 in., 34 x 42 in., 42 x 72 in. Other sizes can be manufactured to specification.

Pacific Plastic Machinery, Inc, 3343 S Lawndale St, Chicago 23, Ill

MORE DATA? Circle 82, inside back cover



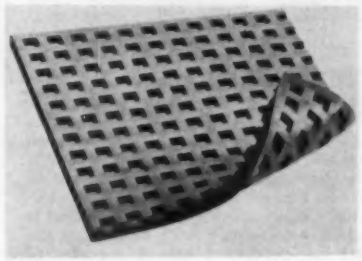
Adjustable Drillhead Allows Multiple Spindle Drilling

Multiple-spindle drilling of large holes in hard-to-machine material is now practical with this new double-eccentric adjustable drillhead. The 2-spindle head with templet (above) drills 2-in. diameter holes in solid steel forgings. As a size comparison, a spindle bracket assembly from a similar head for ¼-in. drills in steel is shown on the left side of the larger drillhead.

Each spindle of the Superheavy duty drillhead adjusts anywhere within a radius of 7.2 in. about the drive and a maximum center distance of 22.4 in. is possible.

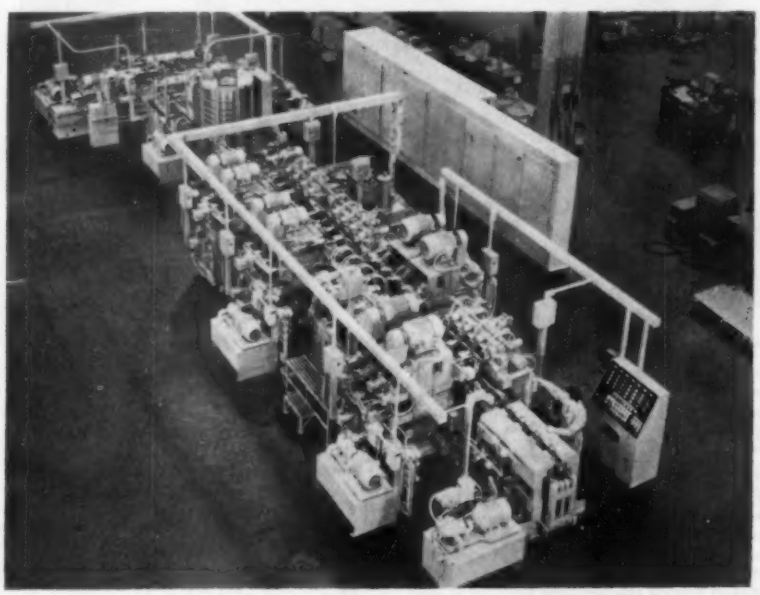
Thriftmaster Products Corp, 1048 N Plum St, Lancaster, Pa

MORE DATA? Circle 83, inside back cover



FABCEL PADS eliminate need for bolts, lag screws, or cement under most machines. Suction cells anchor machines to floor while at same time control vibration, absorb shock, reduce noise, and improve machine performance— ***Fabreeka Products Co, Inc, 1190 Adams St, Boston 24, Mass***

MORE DATA? Circle 84, inside back cover



FIRST SECTION of sectionized chucking transfermatic includes new building blocks for turning operations. The first two sections of the three-section machine are joined by a rotating-drum storage bank whose speed can be varied to help balance output from the two sections. Drilling, broaching, and assembly operations are performed on one piece at a time in second and third sections— ***Cross Co, Park Grove Station, Detroit 5, Mich***

MORE DATA? Circle 85, inside back cover

V-R

CREATING THE METALS THAT SHAPE THE FUTURE

Modern equipment assures precise shape and sizes

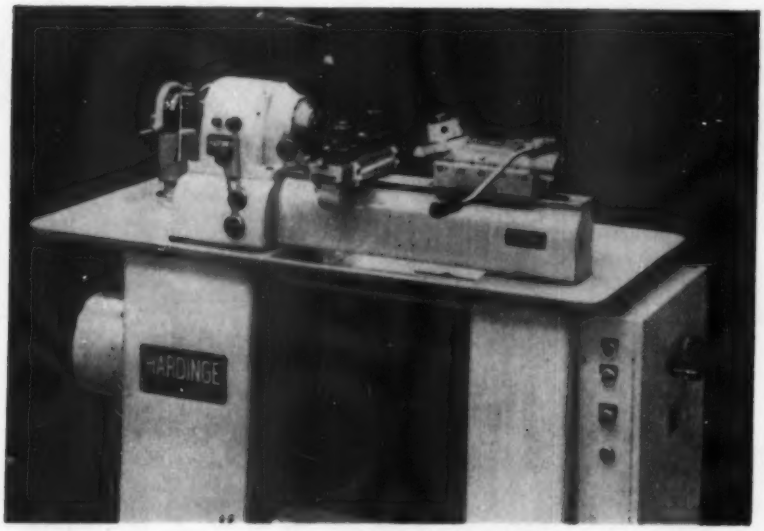
No single method can produce all the sizes and shapes of carbides manufactured at V-R. That is why five different pressing methods are used to meet industry's needs. The press shown here is typical of the modern, precision equipment used to compact carbide at V-R. Regardless of the method used, accurate controls and the knowledge gained through long experience enable V-R to form carbide to exact dimensional requirements and proper density for the very finest cutting tool materials.

WRITE FOR A COMPLETE CATALOG OF V-R QUALITY PRODUCTS OR CALL YOUR V-R MAN.

V-R **VASCOLOY-RAMET**

844 MARKET STREET • WAUKEGAN, ILLINOIS

C-810



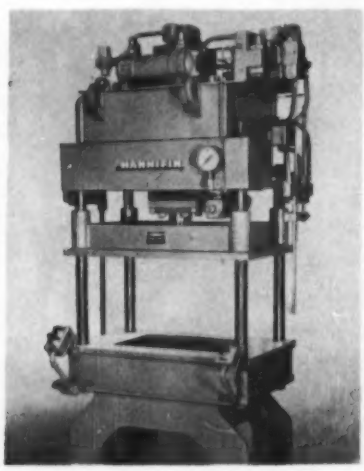
Hardinge Second Operation Machine Takes 1 1/16-in. Rounds Through Spindle

Model DSM59-R, which provides 1 1/16-in. round collet capacity through the spindle, has a step chuck capacity to 6 in., and a swing over the bed of 9 in. Because the headstock spindle is mounted on super-precision preloaded ball bearings, the machine gives carefree spindle speeds up to 4000 rpm. The spindle takes a full range of standard tooling, 5C collets, step chucks, jaw chucks, and face plates.

Other new features are: electric production drive, electric interlock for spindle lock pin, coolant facilities.

Hardinge Brothers, Inc, Elmira, NY

MORE DATA? Circle 86, inside back cover



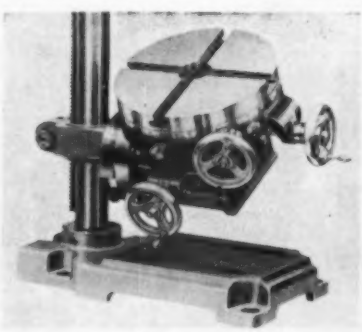
Hannifin 30-Ton Press Features High Speed Advance to 1300 ipm

Although capable of high speed operation to 1300 ipm, the ram speed of this 30-ton, four-column hydraulic trimming press may be reduced to 240 ipm at casting contact. Castings are then trimmed with a squeeze rather than a blow. This soft shearing action gives a cleaner, more accurate trim, reduces the damage to dies, and minimizes rejects.

Other models in T4C series have capacities from 10 to 150 tons.

Hannifin Co, Dept 518, Des Plaines, Ill

MORE DATA? Circle 87, inside back cover



Drillpress Table Fits Bench or Floor Models

Palmgren No. 500 table can be quickly installed on the drillpress column and provides two cross-slide movements together with 360° rotary feed and graduated tilting adjustment. Drilling, milling, grinding, and indexing can be performed without removing the workpiece from the table.

Table diameter is 8 in. graduated 360°. Top surface has two ⅝ x 1⅛-in. T-slots which cross at center. Transverse and longitudinal travel is 4¼ in. and cross feed dials are graduated in thousandths. Rotary feed is positive with worm gear ratio of 40:1. Rotary dial is calibrated in 3-minute intervals.

Chicago Tool & Engineering Co, 8383 S Chicago Ave, Chicago 17, Ill

MORE DATA? Circle 88, inside back cover

Barry Machinery Mount Isolates Horizontal Motion

Series RM Horizontal-force Mount is designed for isolation of shock and vibration produced by machinery whose operation develops predominantly horizontal forces. Each mount will handle up to 4000 lb static load. One Barrymount (10 5/16 in. by 8 in. overall and 1⅝ in. high) is used under each machine foot or support point. An attachment bolt and locknut are furnished with each mount.

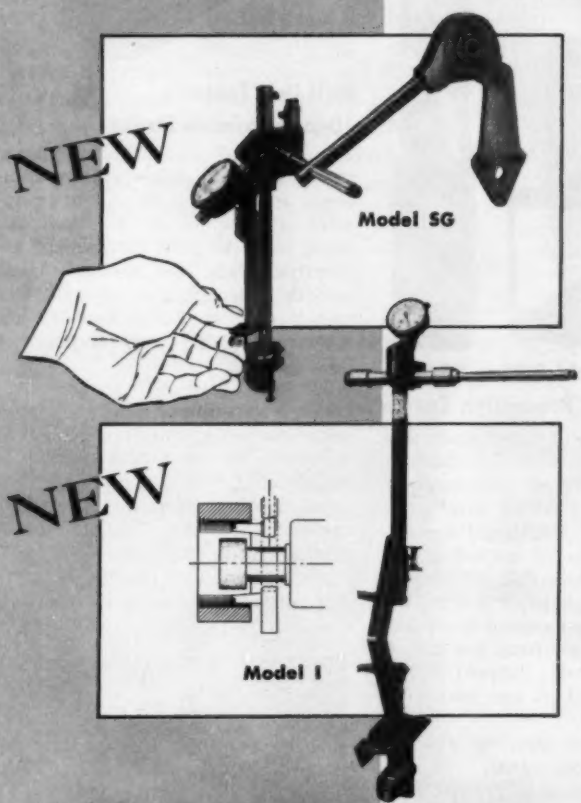
Barry Wright Corp, 700 Pleasant St, Watertown, Mass

MORE DATA? Circle 89, inside back cover

Compact Shearer and Former Has ⅛-in. Capacity in Mild Steel

Small, compact Model P-2 does straight shearing; circle cutting; irregular, slot, and inside cutting;

3 NEW ARNOLD GRINDING GAGES Distributed by FEDERAL



Model LG

Here are three new Arnold Grinding Gages. The Miniature (SG) and King Size (LG) Models now permit continuous measurement for O.D.'s from .060" all the way up to more than 30". And, for the first time, there is an Arnold Grinding Gage to continuously measure I.D.'s. These, like all Arnold Gages, eliminate having to "grind and check". Size of part is shown continuously as metal is being removed, so operator always has positive and precise size control without having to stop his machine until the piece is finished. No oversize regrinds . . . no undersize rejects.

FOR SMALL O.D.'s Model SG

Calipers adjustable from .500" to .093"
Special calipers as small as .060"
Easily adapted to automatic size control of small parts
New style supporting hub

FOR I.D.'s Model I

Checks internal diameters continuously *while* grinding
Contacts adjustable over 1½"
No interference with grinding wheel
Turret-mounted indicator rotates to any position
Easy to position and retract

FOR LARGE O.D.'s Model LG

Continuously measures diameters up to 30" and larger
Single dimension or wide range adjustable calipers
New ball bearing mounting
Rigid, heavy duty frame

ASK FOR CATALOG

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61212 EDDY STREET,
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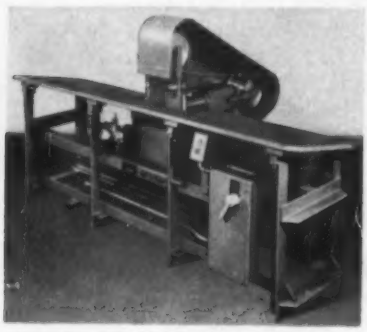
FOR RECOMMENDATIONS IN MODERN GAGES . . .
Dial Indicating, Air, Electric, or Electronic—for Inspecting, Measuring, Sorting, or Automation Gaging

beading; flanging; joggling; edge bending; dishing; or louver cutting on steel up to ⅛ in. thick.

Machine operates with a stationary lower tool and a reciprocating upper tool that penetrates to the shearing point of metal and leaves a smooth edge that requires no further finishing. Larger models are capable of shearing mild steel up to 13/32 in. in thickness.

American Pullmax Co, 2455 N Sheffield Ave, Chicago 14, Ill

MORE DATA? Circle 90, inside back cover



Abrasive Belt Head Incorporates Resilient Driven Back-Up Belt

Greatly increased belt life is now available with this new abrasive belt head machine. The belt travels on a resilient driven back-up belt which is supported at work position by a steel platen. Back-up belt, constructed of rubber and fabric, saves wear and tear on the abrasive belt by providing resilience for the cutting grain and giving it a moving support as it crosses the steel platen at work position. Standard abrasive belts may be used.

Murray-Way Corp, PO Box 180, Birmingham, Mich

MORE DATA? Circle 91, inside back cover

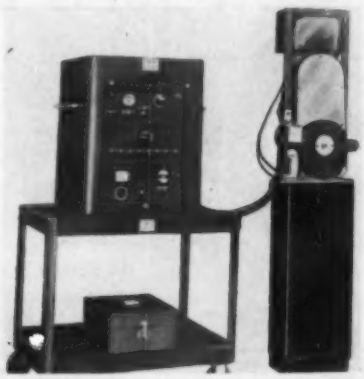
Automatic Recessing Toolholders Offered With New Design Features

Four basic tool series comprise the line—Types FR and CF for piloting in a jig or fixture bushing, and Types FRMP and CFMP for piloting in work. Each individual type is supplied in four basic models, each having different dimensions to cover a wide range of applications.

Design features include a double cam track in large diameter of shank which produces a stronger tool; minimum helix angle providing a more uniform feed with less pressure; and a greater throw which gives wider range and longer tool life.

Erickson Tool Co, 34350 Solon Rd, Solon, Ohio

MORE DATA? Circle 92, inside back cover



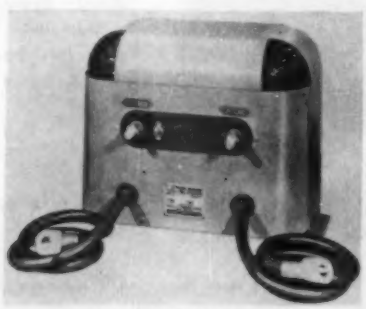
Detector for Cold Drawn Wire Finds Flaws at Production Speeds

The Rototester will detect open surface flaws of 0.004 in. or more in depth in magnetic or non-magnetic cold drawn steel coiled wire up to 1 in. in diameter. Utilizing the eddy-current technique of inspection, the rotating head mechanism mounts directly on the draw block and the detector unit rotates around the drawn wire as it emerges from the die. At production speeds (approximately 200 fpm), flaws 1 in. and longer are detected.

Flaws are indicated by a visual light and an audio signal.

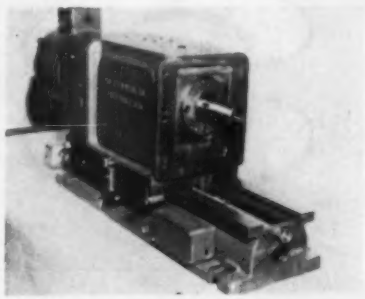
Magnetic Analysis Corp, 42-44 Twelfth St, Long Island City, NY

MORE DATA? Circle 93, inside back cover



HIGH FREQUENCY AUTOMATIC arc starter and stabilizer, for use with any ac or dc welder, is designed to eliminate false starts even with low open-circuit voltage, and to stabilize the arc on low-current settings for thin gage welding—*Metal & Thermit Corp, Rahway, NJ*

MORE DATA? Circle 94, inside back cover



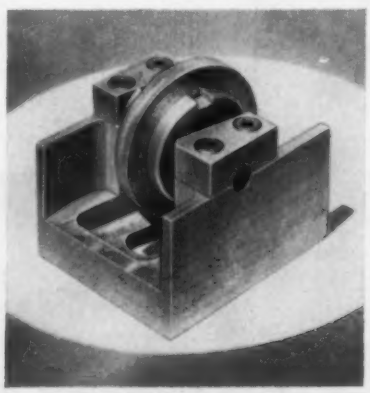
Drill Unit Features 10-in. Maximum Stroke

The Pneumech, featuring maximum stroke of 10 in, allows many additional operations with present equipment. Combining air for feed and rapid traverse with mechanical restrictive forces, feed is constant and smooth. Through gear changes feed variations from 0.0016 to 0.015 and speeds from 287 to 4600 rpm are possible.

This way-type unit can be readily adapted to single or multiple spindle heads, reaming, counter boring, and allied operations with maximum 2-hp capacity. Positive stops regulate depth control and provide repetitive accuracy of 0.001. Compact design permits ready insertion.

Hoefer Mfg Co, Freeport, Ill

MORE DATA? Circle 95, inside back cover



Diamond Dressers Offered In Two New Models

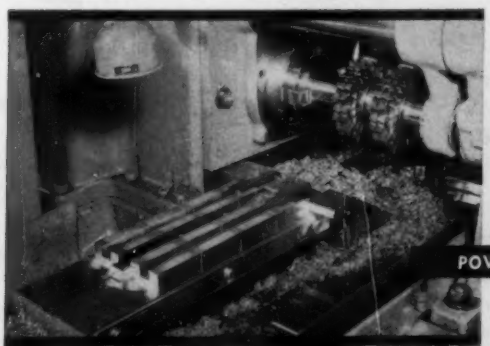
Model 11 is designed for surface grinders, with or without a magnetic chuck; Model 12 is for Cincinnati centerless grinders. Diamond concentration comes in 1/16 and 1/8-in. depths on wheels of either ¼ or ½ in. wide. The dressers are set on a tangential angle to eliminate the need for a breaking device.

L Newman, 1001 24th St, Oakland 7, Calif

MORE DATA? Circle 96, inside back cover

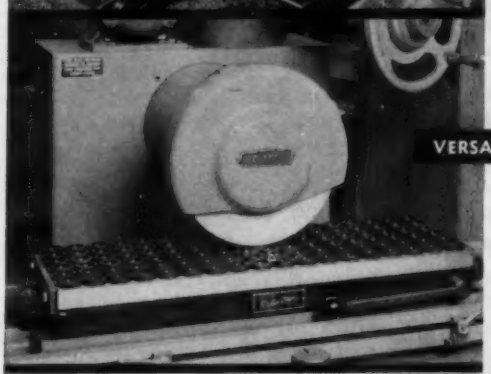
Dependability in MAGNETIC CHUCKING means *Walker*

Walker Ceramax permanent magnetic chucks are designed to give the day after day dependable, trouble-free performance that means the maximum use of production time. Ceramic permanent magnets, with three times the coersive force of ordinary Alnico magnets, maintain their strength indefinitely.



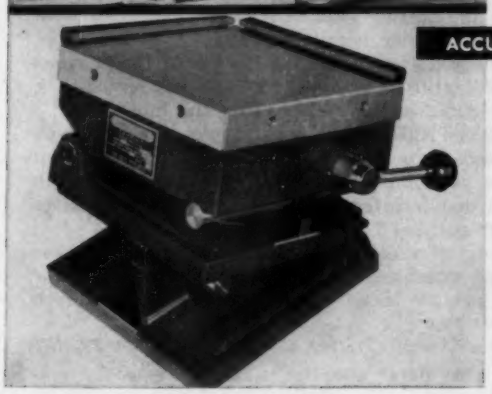
POWER

Dependable power is readily available for quick, easy holding of ferrous materials, enough power to make the Ceramax chuck adaptable to many milling set-ups. With new Ceramic magnets you can be sure the power is always there.



VERSATILITY

Dependable versatility results from the ¼" poles that permit holding both small and large work on the same chuck without the need for auxiliary top plates. New Ceramic magnets allow each pole to be uniformly and individually magnetized. Stock as thin as .020" can be securely held.



ACCURACY

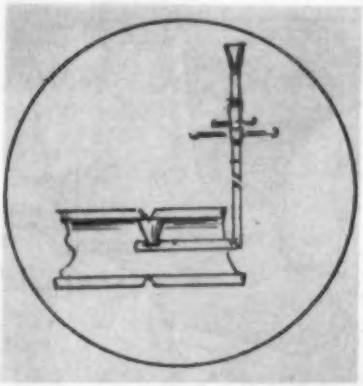
Dependable accuracy is illustrated by the fact that Ceramax chucks are used exclusively by Ex-Cell-O Corporation, Greenville Ohio plant, with the magna sine plate.

When buying magnetic chucks, specify Walker.

O.S. Walker Co., Inc.

ROCKDALE ST. • WORCESTER 6, MASS.

Original Designers and Builders of Magnetic Chucks



Optical Instrument Inspects Parts That Have Offset Entrance Hole

The Inspect-O-Scope is used to inspect pipes, steam lines, boiler tubes that have an offset entrance hole. The user may look for imperfect weld seams, flaws, obstructions, and any other not readily identifiable variation in the parts being inspected.

The device can enter an opening as small as a ½-in. pipe thread hole. It consists of a hinged optical section, the lower portion of which can be positioned at 90° to the entrance axis after insertion of the instrument into the object being examined. By turning the scanning control knob, the objective window and light source can be rotated through an arc of 360°. The indicating dial below the scanning knob accurately identifies the position of the area being observed. The instrument is designed to work to 500 F.

Size Control Co, 2500 W Washington Blvd, Chicago, Ill

MORE DATA? Circle 97, inside back cover

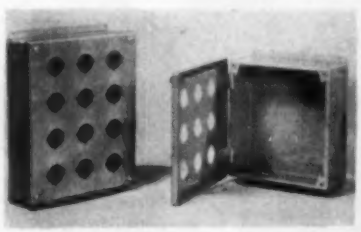
Airco Markets Power Source for Tungsten Arc Welding Process

C-Bee (capacitor balanced) balanced wave Heliwelder—which is a balanced wave, transformer type power source for use with tungsten arc welding equipment (Heliweld)—is said to be exceptionally good for welding aluminum and magnesium using alternating current. It can be used with both manual and semi-automatic or automatic Heliweld equipment.

Features include: capacitor balancing; high open-circuit voltage (165 v) for maximum arc stability; five overlapping ranges for applications from 20 to 400 amps; good wave form in all ranges; electric control of amperage output.

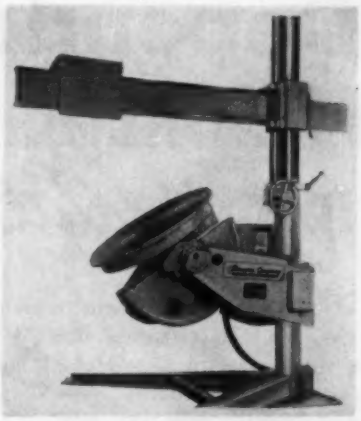
Air Reduction Sales Co, Div of Air Reduction Co, Inc, 150 E 42nd St, New York 17, NY

MORE DATA? Circle 98, inside back cover



LINE OF OILTIGHT pushbutton enclosures will accommodate all makes of standard oiltight pushbutton pilot lights, switches, etc. A neoprene cover gasket and welded seams assure protection—*McKinstry Metal Works, Inc, 285 McKinstry Ave, Chicopee, Mass*

MORE DATA? Circle 99, inside back cover



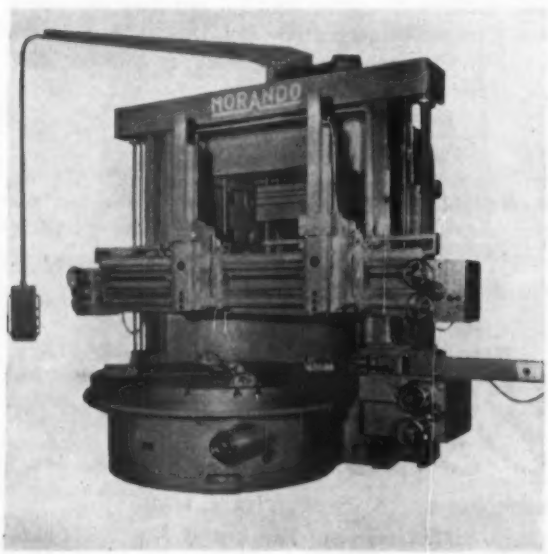
Combined Positioner-Manipulator Introduced by Ransome

Unit is a complete automatic welding station—a 4 x 4-ft manipulator combined with a Model 25P positioner. Joining the two units, accomplished by fitting the manipulator mast into the positioner post, creates a single free standing piece of equipment which performs the two basic positioning operations.

The Model 25P positioner, capable of handling 2500 lb, features precision electronic variable speed drive, power operated tilt, and remote control station. Manipulator is manually elevated for arc height adjustment by means of an Acme screw, and the head support side beam carriage is manually adjusted with a rack and pinion and lock to cover the welding area handled by the positioner table.

Ransome Co, Scotch Plains, NJ

MORE DATA? Circle 100, inside back cover



Morando Vertical Turning, Boring Machine Said to Pass Maximum HP to Cutting Tool

Because it has an integrated spindle construction that makes a single unit out of the driving gearwheel, flange, and crown, this VK vertical boring and turning machine is said to guarantee that maximum horsepower is delivered to the cutting tool. This, when combined with high precision roller bearings located at both ends of the spindle, gives very good rigidity under the heaviest cutting stress; this is true at both high and low speeds, and when cuts are made high above the table.

The user can select three speed ranges—each of which has 16 speeds—according to his needs. Several different tables are available: 3-jaw dual control; 4-jaw with embedded and inserted independent jaws; flat surface chuck with parallel T-slots.

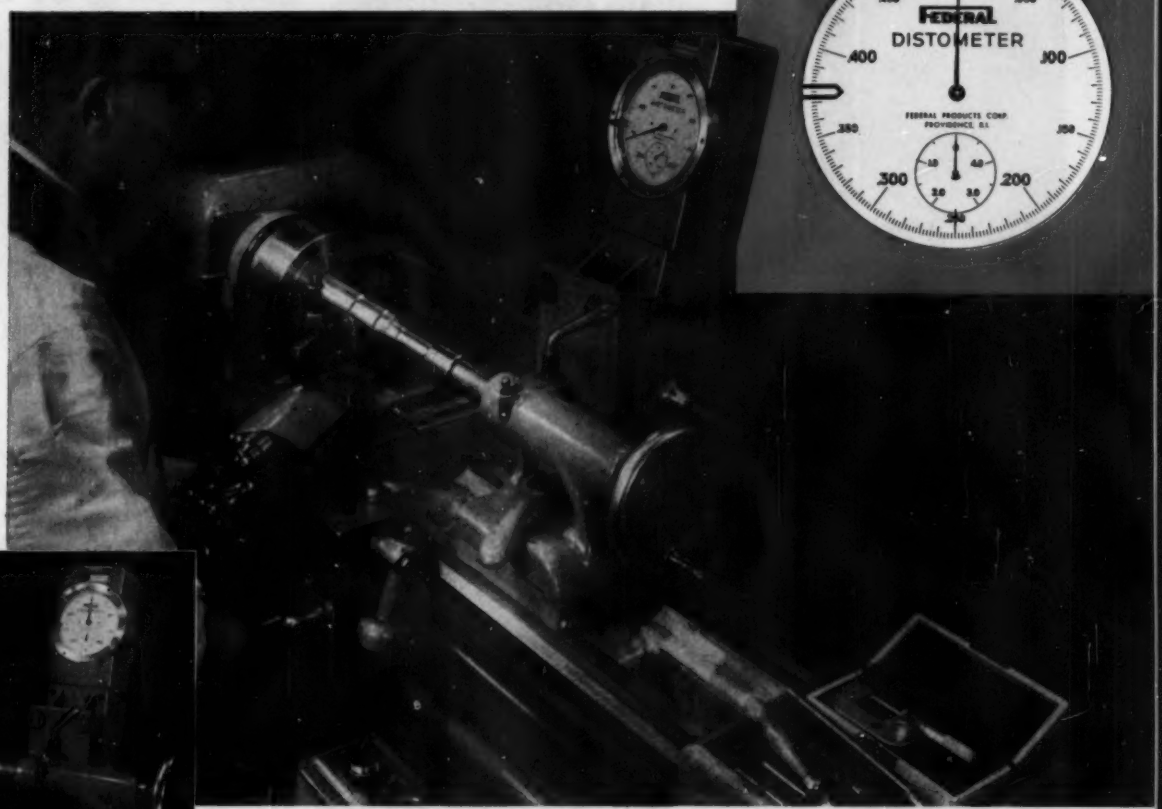
Presetting of a complete cycle is possible with the turret slide attachment, because micrometer automatic stops can operate in all 4 working directions for each turret position.

S & S Machinery Co, 140 53rd St, Brooklyn 32, NY

MORE DATA? Circle 101, inside back cover

Right before your eyes...

A 27% (or more) INCREASE in LATHE PRODUCTIVITY!



Push-Button Zeroing . . . you're instantly and automatically ready to measure off the next distance.

The DISTOMETER, a totally new precision instrument, greatly increases lathe output . . .

Because —

- It provides a much faster, more convenient and more reliable means of spotting tool position and measuring longitudinal cutting distance than any other available device.
- It has motorized, Push-Button Zeroing. Lets you reference instantly at any point in the carriage travel for continuous measurement to any other point.
- It puts accurate, well magnified, man-size readings in front of the operator so he can follow progress of the tool and know instantly when it has covered the required distance.
- It requires no set up, no positioning, no mastering. Ready to measure *directly* at the touch of a button.

ANY MANUALLY OPERATED LATHE . . . OLD OR NEW . . . BIG OR SMALL . . . CAN USE THE DISTOMETER PROFITABLY!

Write for brochure.

FEDERAL PRODUCTS CORP.
61212 Eddy Street, Providence 1, R. I.

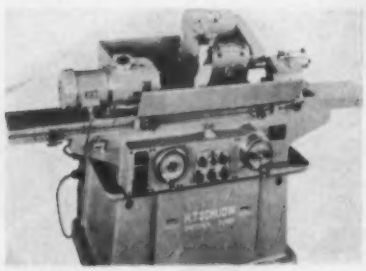
Ask **FEDERAL** *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .
Dial Indicating, Air, Electric, or Electronic—for Inspecting, Measuring, Sorting, or Automation Gaging

CIRCLE 350 READER SERVICE CARD

TEN-STATION DIAL INDEX MACHINE combines assembly, drilling, spotfacing, and straddle milling operations in processing 212 transmission cover torus assemblies an hour. Machine features tilting quill units that lower a bushing plate into the center hub of the part to obtain tool stability and accuracy in drilling an integral oil hole—*F Jos Lamb Co, 5663 E Nine Mile Rd, Detroit 34, Mich*

MORE DATA? Circle 102, inside back cover



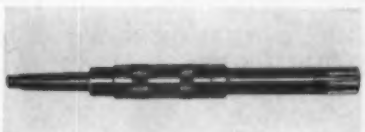
Swiss Grinders Give Close Tolerance Without Electronics

Tschudin, a line of Swiss universal grinders, are fully hydraulic, and give close tolerance without the use of expensive electronic equipment. However, electronic sizing and mating equipment is available.

The grinders are avai'able in 3 sizes: 8 x 12 in., 8 x 16 in., and 8 x 24 in. Some highlights are: infeed repeats within 20 millionths; work spindle runs round within 25 millionths.

Alina Corp, 122 E 2nd St, Mineola, Long Island, NY

MORE DATA? Circle 103, inside back cover

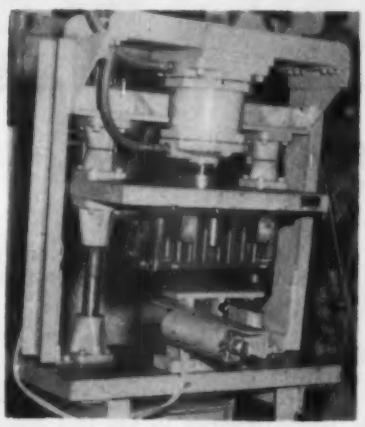


Hole Finishing Tool Improves Surface Finishes

Tool, which is said to improve surface characteristics by as much as 100 times, is an offshoot of the bearingizing process, developed by Cogsdill, called Roll-A-Finishing. This process reduces 80 to 200 micro-in. surfaces to ±0.002 to ±0.0025 tolerances and 2 to 10 micro-in. finishes. Special high speed equipment is not necessary.

Cogsdill Tool Products Inc, 12980 W Eight Mile Rd, Oak Park 37, Mich

MORE DATA? Circle 104, inside back cover



Air Bender's Design Minimizes Possibility of Scuffing

Beacuse of the Air Bender incorporates the wrapping follow-through of the old hand-operated bar-folder, there is no possibility of scratches from pickup on die faces. Side flanges can be handled and ironed during the folding operation to prevent wrinkles or puffing either on the face of the sheet or along the side flanges.

The equipment shown will make bends 12 in. wide and form legs 12 in. long in 22-gage steel. Working ram area is 13 in. F to B, 18½ in. L to R. Bed area is 18½ in. square.

Burditt Corp, 13 N Union Ave, Cranford, NJ

MORE DATA? Circle 105, inside back cover

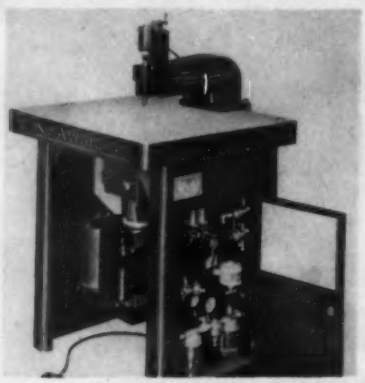
60-ton OBI Press Offered With Choice of Clutches

Rousselle No. 6, designed for handling heavy and varied high-speed work, can be furnished with a heavy-duty heat-treated alloy steel clutch equipped with large clutch plate which eliminates backup pins and locks flywheel in both directions.

Depth of throat is 10 in.; standard stroke is 3 in.; strokes per minute, flywheel type, 105.

Service Machine Co, Chicago 20, Ill

MORE DATA? Circle 106, inside back cover

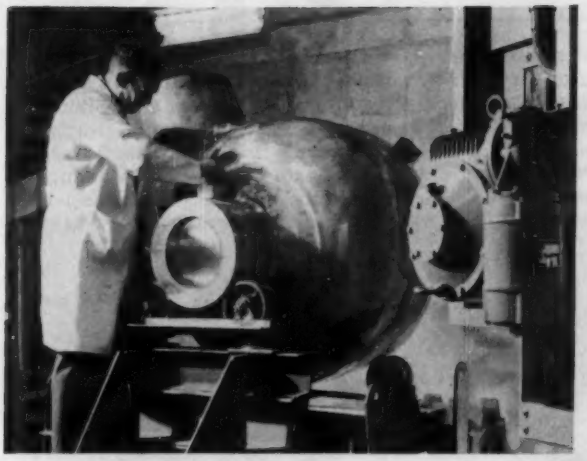


Circuit-Board Drilling Machine Drills 64,000 Holes per Shift

Model 151 drills holes from 0.020-0.250 in. in diameter. Each hole can be within 0.001 in. of true position and minimum wall thickness between holes is 0.004 in. Boards can be drilled individually or a stack of five can be processed simultaneously. Drill thrust ranges up to 400 lb.

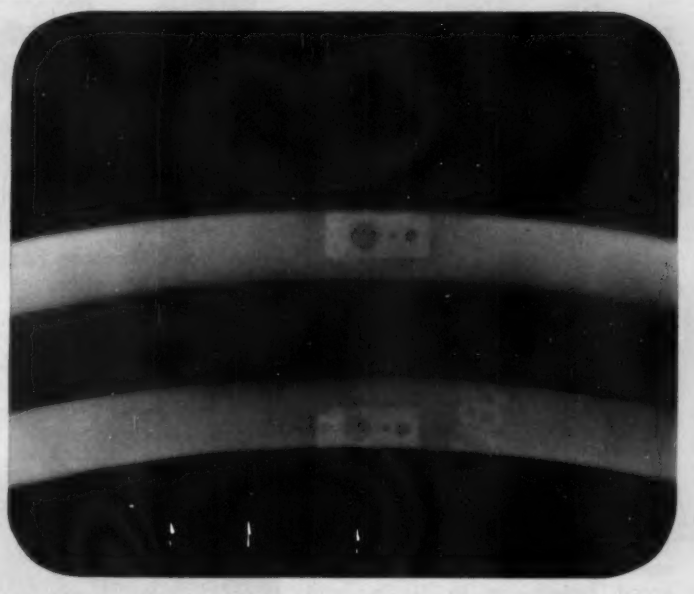
Nawide Machine Tools Div of Nationwide Engrg Service Inc, 6138 Washington Blvd, Culver City, Calif

MORE DATA? Circle 107, inside back cover



Navy Recruit passes its physical

Vitally important nuclear part must be sound beyond question. Electric Steel Foundry Company makes sure with radiography using Kodak Industrial X-ray Film.



THIS CASTING is going to sea—as an important part of an atomic propulsion unit. Its specifications are precise and rigid. It must be flawless. To be certain that it *is* right and to have recorded evidence, Electric Steel Foundry Company radiographs the casting with a Betatron and Kodak Industrial X-ray Film.

Today's demand for sound castings calls for radiography to provide proof of quality. This assurance—that highest quality castings are being delivered by a foundry goes a long way to build sales.

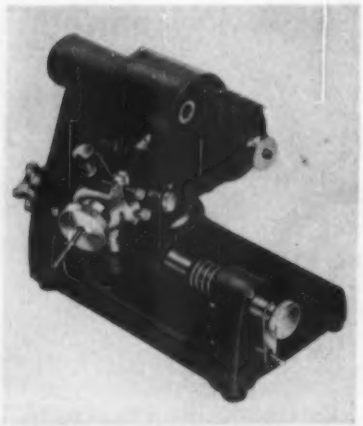
If you would like to know how radiography can work profitably for you, talk it over with an x-ray dealer or write us for a Kodak Technical Representative to call.

Read what KODAK INDUSTRIAL X-RAY FILM, TYPE AA, does for you:

- ★ Speeds up radiographic examinations.
- ★ Gives increased detail visibility and easy readability at all energy ranges because of high film contrast.
- ★ Provides excellent uniformity.
- ★ Reduces the possibility of pressure desensitization under shop conditions.

EASTMAN KODAK COMPANY
X-ray Division Rochester 4, N.Y.

Kodak



Bench Model Cutter Grinder Has Built-in Preset Adjustment

Model can be used for grinding all engraving cutters used on pantograph machines and all two-lip milling cutters. Construction makes it possible for inexperienced operators to grind cutters concentrically, with any desired profile and proper clearance. Toolhead has an automatic setting for angular and clearance uniformity. All necessary grinding operations from start to finish are done without the cutter being removed from the grinder; for repetitive duplications of a given angle or clearance, a preset adjustment is built into the machine.

Design of the grinder allows tipping with the cutter remaining clamped in the toolhead, important for accurate rake angle and clearance. Toolhead will handle all high-speed cutters up to ½ in., and tapered cutters as well. It is calibrated to 180° on angular adjustment. Cutter feed dial is graduated to 0.001 in.

New Hermes Engraving Machine Corp, 154 W 14th St, New York 11, NY

MORE DATA? Circle 108, inside back cover

Magnetic Particle Inspection System Offered by Budd

Recordaflux (formerly know as Permaweld) is used to detect defective welds, cracks, inclusions, and other flaws in such materials as are currently inspected by magnetic particle systems.

The system offers to industry specially developed solutions that contain magnetic particles. When sprayed or poured on the surface of a part, the particles are free to migrate in the solution. When the solution sets up as a strippable plastic film, the magnetic particles are frozen in place. The first two solutions being offered have setting-up times of 20 minutes and 8 minutes respectively without external heat or drying.

Budd Co, Instruments Div, Box 245, Phoenixville, Pa

MORE DATA? Circle 109, inside back cover

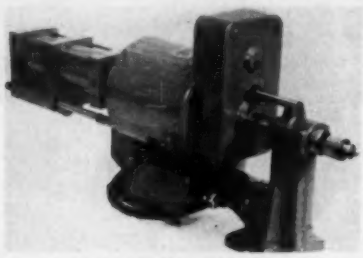
DoAll Band Machine Has Roller Mounted Table

Model 1612-UGT has a 16-in. throat and 12-in. work height. The 24 x 24-in. worktable, mounted on 8 anti-friction precision rollers, has 12 in. of manual travel or 8 in. of travel with the weight type power feed attachment. For full utilization of this feature, a work stop and mitering attachment are furnished.

Infinitely variable band speeds from 50 to 5200 fpm in two ranges enable the machine to utilize a 1-hp motor and a wide range of saw bands from 1/16 to 1/2 in. wide.

DoAll Co, Des Plaines, Ill

MORE DATA? Circle 110, inside back cover

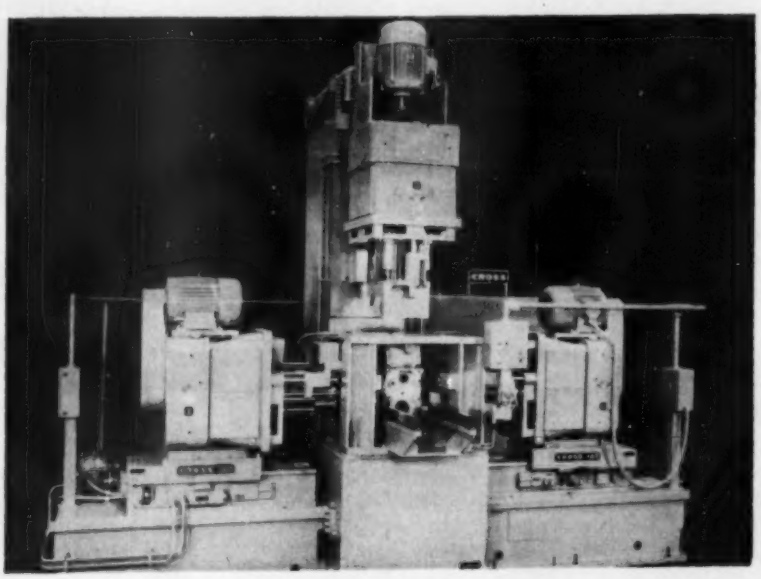


Small Hole Drilling Unit Has 3½-in. Stroke

Model 113-3½ in. has an electric motor spindle and air feed with hydraulic control. Seven sets of timing belts and pulleys provide spindle speeds from 750 to 15,800 rpm. Chuck capacity is ¼ in.

Electro-Mechano Co, 241 E Erie St, Milwaukee, Wis

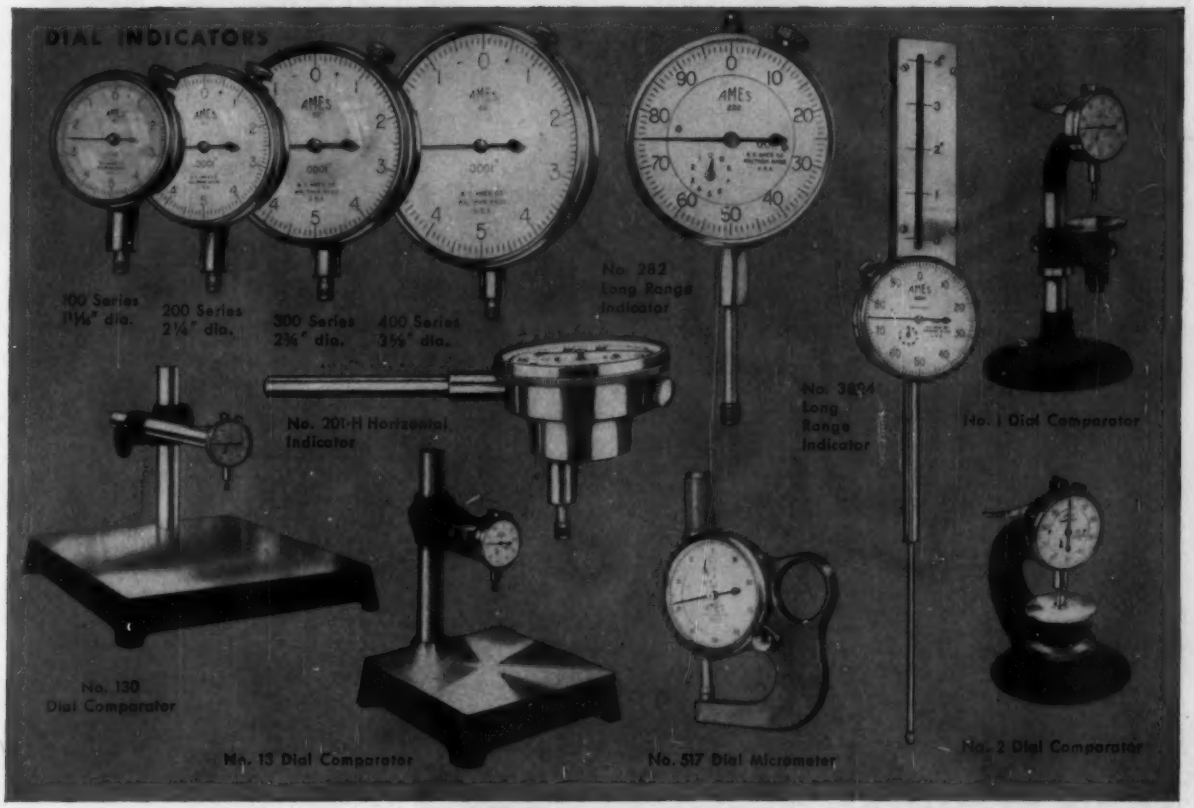
MORE DATA? Circle 111, inside back cover



ONE OF SEVEN way-type machines installed for a tractor manufacturer to give more versatility than complete automation. The series of machines can machine six styles of heavy clutch housings cast in two different lengths. Machines, with cycle time of 3 min, greatly increase production flexibility and readily adapt to design changes. Triangular carbide inserts are used for boring and facing cuts—*Cross Co, Park Grove Station, Detroit 5, Mich*

MORE DATA? Circle 112, inside back cover

AMES *Masters of Measurement*



DIAL INDICATORS AND GAUGES

Use Them for Checking: taper, height, depth, flatness, roundness, straightness, thickness, diameter, length and size.

Features Include: easy-to-read dials, unbreakable crystals, forged cases, backs and wheel support, contour-lapped pinion teeth.

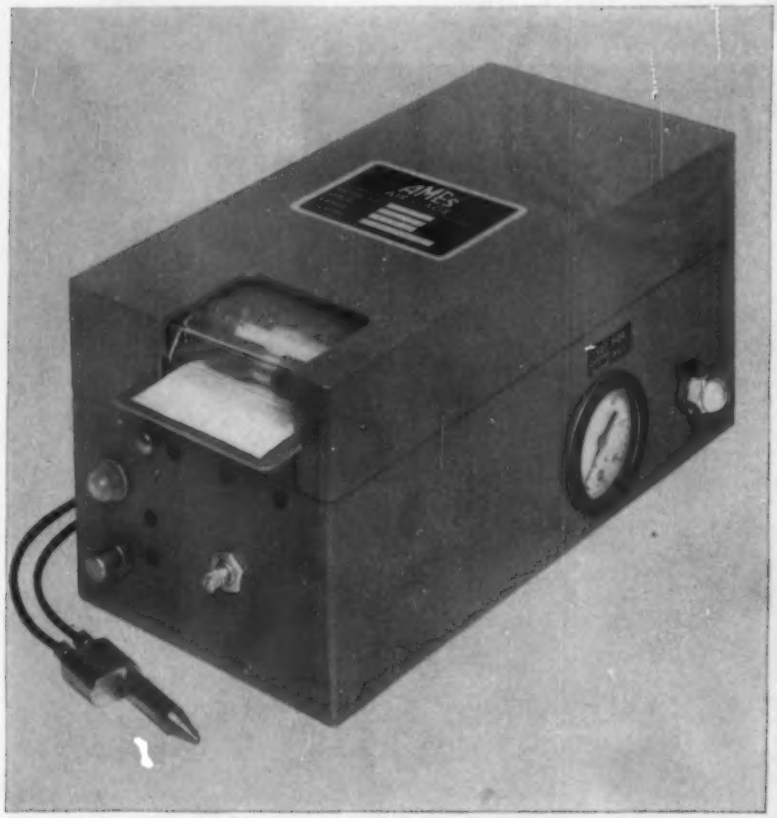
Attachments: rubber and metal dust guards, long stem indicators, tolerance hands, lift levers, special backs, contact points, etc.

For literally hundreds of measuring, indicating and comparing operations, you'll find Ames standard and customized gauges and indicators unerringly accurate and amazingly durable . . . *You're asking for the best when you specify Ames!*
B. C. AMES CO., Waltham 54, Mass. Representatives in Principal Cities—
In Canada, H. C. Burton Co., 166 Rebecca Street, Hamilton, Canada.

B.C. AMES CO.

MANUFACTURERS OF MICROMETER DIAL INDICATORS, DIAL GAUGES, ACCU-FLOW AIR GAGES, PORTABLE TRANSISTORIZED COMPARATORS

AMES *Masters of Measurement*



ACCU-FLOW Air Gaging Equipment

The new line of ACCU-FLOW air gages developed by B.C. Ames includes several patented components, including nozzles and pressure indicators, which give these gages unusual range and exceptional linearity.

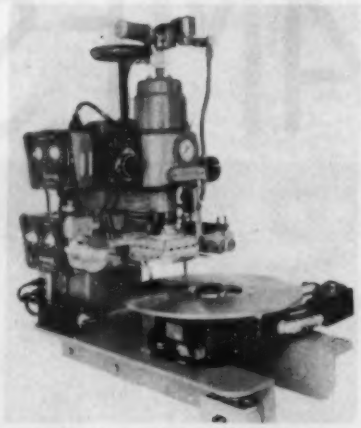
Special Models are Available for Checking: outside and inside diameters, center distances, flatness, roundness, hole depths and continuous noncontact measuring or comparing of paper, metals, plastic films, etc.

Ames ACCU-FLOW Air Gages are providing the answer to many measuring problems that were once considered impossible to solve. For complete information on the entire line of Ames air gaging equipment, write for new ACCU-FLOW folder. *You're asking for the best when you specify Ames!*

B. C. AMES CO., Waltham 54, Mass. Representatives in Principal Cities—In Canada, H. C. Burton Co., 166 Rebecca Street, Hamilton, Canada.

B.C. AMES CO.

MANUFACTURERS OF MICROMETER DIAL INDICATORS, DIAL GAUGES, ACCU-FLOW AIR GAGES, PORTABLE TRANSISTORIZED COMPARATORS



Dial Feeding Unit Designed For Use With Acroleaf Press

A 4, 6, 8, 12, 24-station dial as a separately operated unit used in combination with the Acromark Model 212 hot stamping machine can be mounted in any desired position beneath the Acroleaf press ram. Dial plates are removable; sizes from 10 to 20 in. can be handled. Unit is controlled separately by an electric-air solenoid valve with low voltage triggering and independent speed controls.

The machine illustrated has a loading timer for presetting loading speed and a separate timer to control the marking dwell. Operating speeds up to approximately 50 parts per minute can be attained.

Acromark Co, 7-13 Morrell St, Elizabeth, NJ

MORE DATA? Circle 113, inside back cover

Dial-A-Breaker Kendex Toolholders Provide Close Control of Chips

Toolholder permits fine adjustment of the chip breaker and close control of chips in machining operations. A knurled thumb nut or dial on a screw provides an infinite number of chip breaker positions. The adjusting nut is readily accessible on top of the toolholder regardless of tool position. The solid Kennametal chip breaker,

to which the screw is attached, retains its position while indexing or changing inserts.

There are 70 styles and sizes available. All have the same basic design as standard Kendex tooling and take standard square and triangular throw-away inserts and solid Kennametal shims.

Kennametal Inc, Latrobe, Pa

MORE DATA? Circle 114, inside back cover

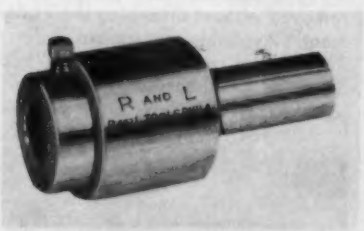
Lowcost Pillow Block Unit Incorporates Quality Bearings

Economical pressed steel housings provide a precision bearing-to-housing fit and a true self-aligning bearing that effectively bridges the gap between light duty pressed metal housings and heavy duty cast iron housings. Design permits the use of standard Fafnir rubber contact seal bearings with self-locking collars.

Known as the PBS, the unit takes shaft sizes between ½ and 1 7/16 in. It is suitable for most pillow block bearing applications where moderate speeds, moderate radial loads, and relatively light thrust loads are encountered.

Fafnir Bearing Co, 37 Booth St, New Britain, Conn

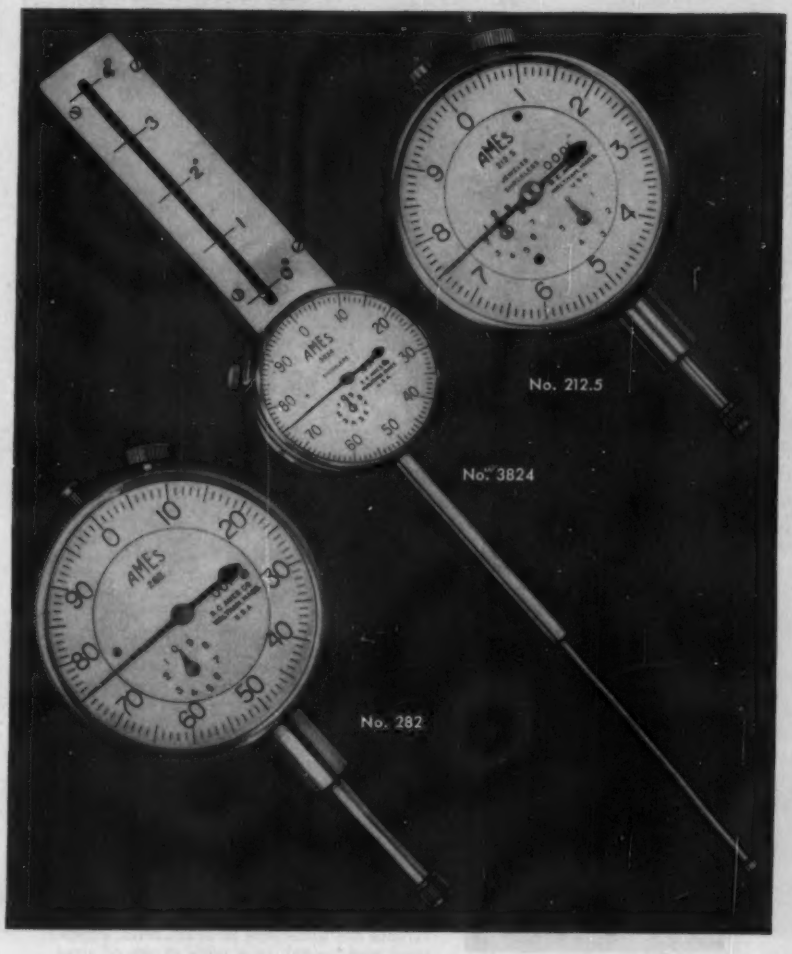
MORE DATA? Circle 115, inside back cover



TAP AND DIE HOLDER (for acorn or button dies) features a highly efficient releasing mechanism and can be easily changed for either RH or LH threading and tapping. Clutch in the holder instantly locks into position as soon as tap or die engages the work. Shank sizes range from ⅜ to to 1½ in.—*R & L Tools, 1825 Bristol St, Philadelphia 40, Pa*

MORE DATA? Circle 116, inside back cover

AMES *Masters of Measurement*



Long Range Dial Indicators

Use Them for Checking: long slide travel, large cams, deep recesses or other dimensions requiring indicator spindle travel up to 12".

Features Include: large diameter dials, widely spaced dial graduations, movable dials, replaceable contacts and count hands.

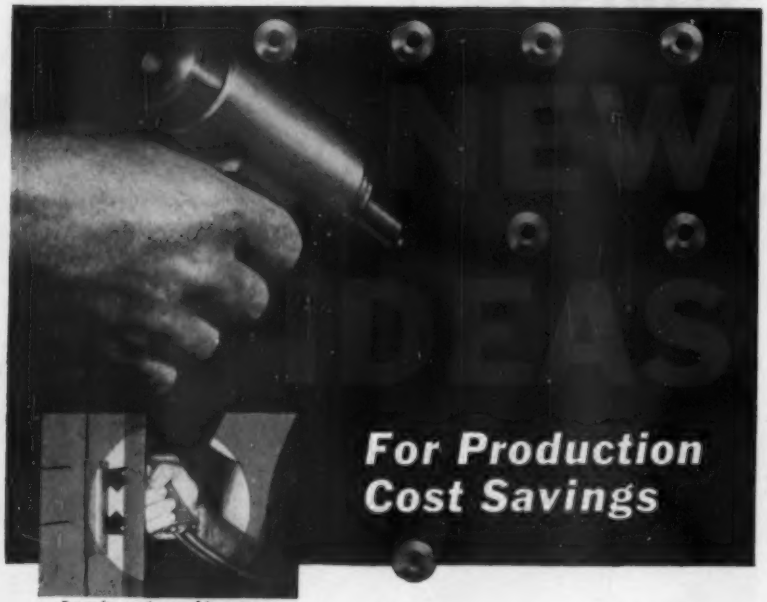
For literally hundreds of measuring, indicating and comparing operations, you'll find Ames standard and customized gauges and indicators unerringly accurate and amazingly durable . . . *You're asking for the best when you specify Ames!*

B. C. AMES CO. Waltham 54, Mass. Representatives in Principal Cities—In Canada, H. C. Burton Co., 166 Rebecca Street, Hamilton, Canada.

B.C. AMES CO.

MANUFACTURERS OF MICROMETER DIAL INDICATORS, DIAL GAUGES, ACCU-FLOW AIR GAGES, PORTABLE TRANSISTORIZED COMPARATORS

FROM UNITED "POP" RIVETS...



Fastening parts on refrigerators, ranges and other appliances.

High speed fastening on aluminum furniture and windows.

Blind fastening for air frame assembly and repair done quickly and easily.

High speed riveting for panels in car and trailer bodies.

United "POP" Rivets bring a whole new concept of production convenience, cost savings and fastening speed and flexibility.

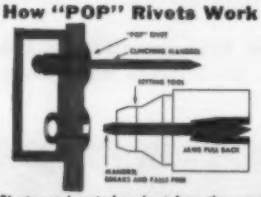
Developed originally as a new type of blind fastener — inserted and set from the same side — "POP" Rivets are delivering savings of 50% and over on installed costs in joining all types of materials on all types of products. A few examples of the most successful are shown at the left. "POP" Rivets are vibration-proof, hold on thick or thin sheets, have low head profile, high clinch, and need less than one-quarter inch backup space. They can be installed at the work without moving assemblies or parts.

Power Tools — inexpensive and light-weight — provide high speed and flexibility for production line work, at rates of over 1,000 per hour. And "POP" Rivets are available in aluminum, copper, steel and monel, in a wide range of sizes and head styles.

Why don't you try United "POP" Rivets?

The easy way to get started is with the "POP" Rivet Introductory Kit . . . 240 rivets and a hand setting tool plus complete instructions for only $19.95 prepaid. Or, send for "IDEAS" folder and catalog that shows you how to save money with United "POP" Rivets.

How "POP" Rivets Work



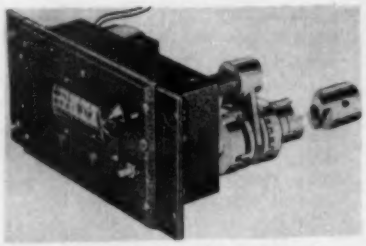
"POP" Rivets are inserted and set from the same side of the work. The retracting jaws in the setting tool pull the mandrel head into the rivet on the reverse side until the mandrel breaks under tension. This high clinch action pulls parts together exerting up to 600 lbs. squeeze and produces a tight, positive, vibration-proof fastening over a wide range of stock variations.

US 0-82

UNITED "POP" RIVETS

"POP" RIVET DIVISION
UNITED SHOE MACHINERY CORPORATION
41512 River Road, Shelton, Conn.
REgent 5-3391

NEW SHOP EQUIPMENT

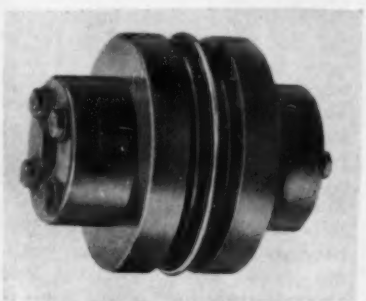


High-Speed Digital Indicator Has Built-In Illumination of Dial

Panel-mounted Model 5-SM-7558 is designed to be used for the indication of roll spacing on steel or brass rolling machinery, tool position on machine tools, and any heavy machinery located in poorly lit areas. The unit incorporates ball bearings and high speed nylon wheels and pinions for counting at rates of up to 15,000 per minute with the standard 10:1 ratio.

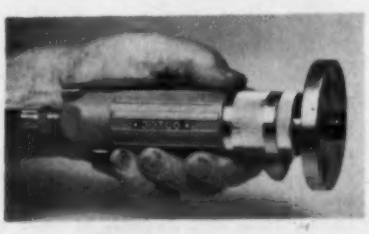
Durant Mfg Co, 1945 N Buffum St, Milwaukee 1, Wis

MORE DATA? Circle 117, inside back cover



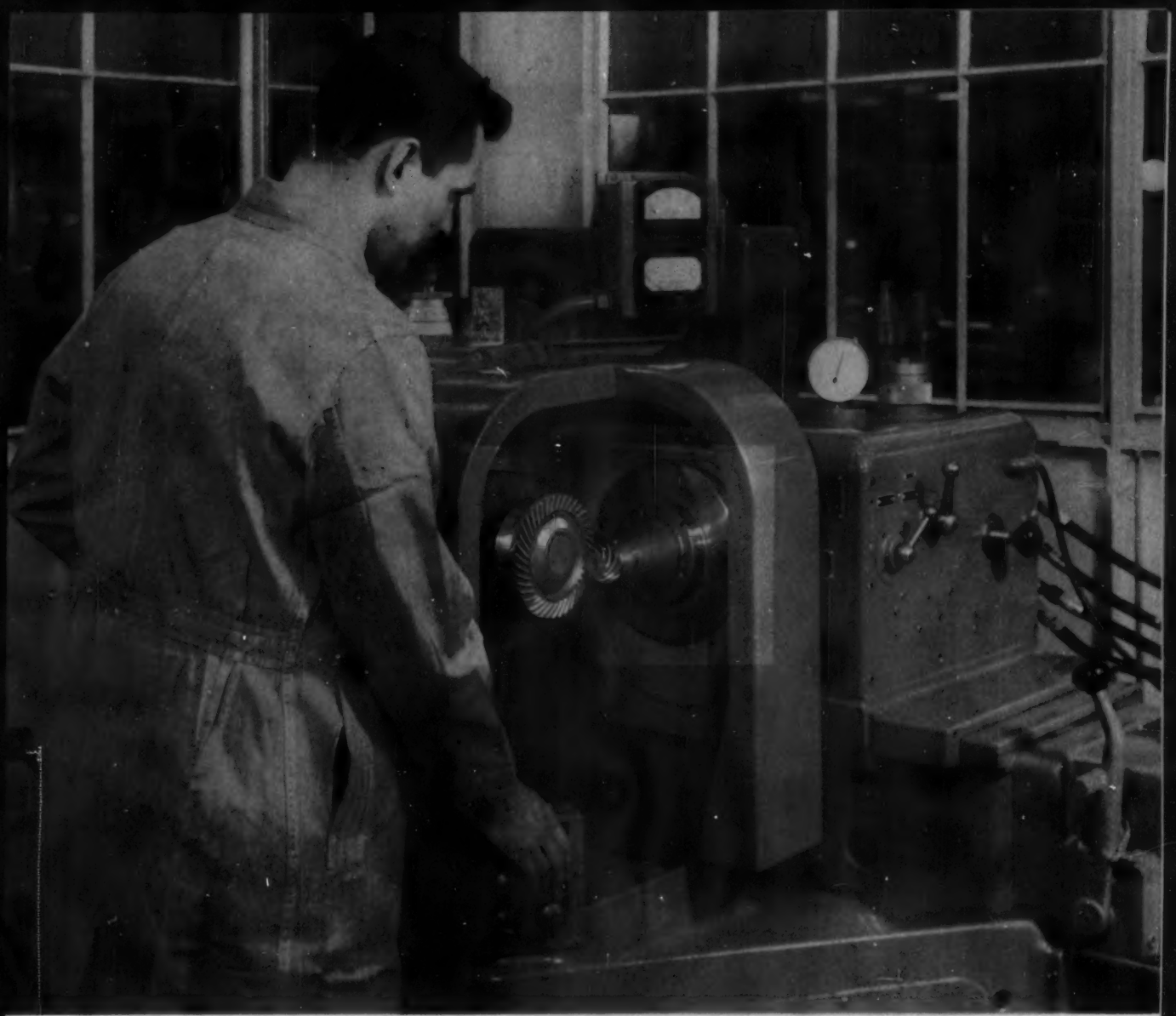
SURE-FLEX SPACER COUPLINGS are equipped with special detachable hubs that permit the coupling of shafts spread as far apart as 7½ in., depending on coupling size. Units can be removed without disturbing shaft alignment. Available on special order to fit particular requirements—*T B Wood's Sons Co, Chambersburg, Pa*

MORE DATA? Circle 118, inside back cover



Compact Portable Router Has 3-in.-dia Working Platform

Router is available for use without alteration on Dotco's high-speed Model 2GL air tool. Its large work-



Now you can *speed-test* gears up to 4000 RPM

Since the accuracy of any gear test depends on how well it simulates actual operating conditions, we've developed a hypoid tester with speeds up to 4000 RPM. The higher range of speed on the No. 17A-4000 Hypoid Tester makes possible a new standard in the testing of bevel gears.

Complete testing on one machine. The No. 17A-4000 Hypoid Tester is arranged for both power and slow rolling tests. With the power test you can observe a gear's smoothness of operation, its noise characteristics, and its tooth contact pattern.

Roll test the gear and you get accurate readings of its eccentricity, tooth size, spacing, and profile.

With the No. 17A-4000 Tester you can test any right angle straight bevel, Zerol® bevel, spiral bevel and hypoid gear of any pitch and up to 20″ OD.

Pre-set backlash control. The No. 17A-4000 Tester has a new hydraulic backlash control mechanism. The control automatically duplicates your pre-set backlash value when you change the relative positions of a gear pair to simulate actual operation.

Exact duplication of settings. Indicator set-up fixtures are available for large quantity testing. With these gages you can make identical settings on a battery of machines, or get the same setting repeatedly on a single machine.

New bulletin. We've prepared a bulletin on the No. 17A-4000 Hypoid Tester to answer any questions you might have about its construction or operation. Write for a copy.

GLEASON WORKS

1000 UNIVERSITY AVE., ROCHESTER 3, N.Y.

CIRCLE 356 READER SERVICE CARD

NEW

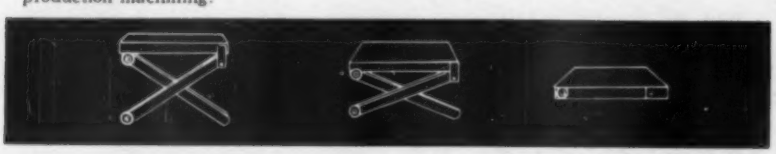
"FEED-UNLOAD" TABLE

AUTOMATES TO YOUR PRODUCTION!

WHATEVER THE MACHINING STEP OR PRODUCTION SPEED, *AUTOQUIP PORTA-LIFT TABLE* GETS THE STOCK THERE, RAISES IT, LOWERS IT . . .

AUTOMATICALLY

Machine production is only as efficient as its "feed-unload" rate! Press, shear, drill, chucker, grinder, stacker, sorter, conveyor line . . . the new Autoquip portable lift table automatically handles stock to your individual requirements. Autoquip Porta-Lift Tables raise and lower with exceptional speed. Adjust rapidly, accurately, responsively to desired levels. Your choice: hand switch, foot switch or automatic controls. "Feed-unload" automatic tables designed to the needs of production machining.



53 fully powered standard sizes with capacities to 48,000 lbs. each automatically raises from "flat as a pancake" to desired heights.

from **$595.00*** (*2000 lbs. capacity)

101 DISTRIBUTORS TO SERVE YOU AND YOUR PORTA-LIFT

Write today for free catalog

Autoquip CORPORATION

1140 SOUTH WASHTENAW • CHICAGO 12, ILLINOIS

NEW SHOP EQUIPMENT

ing platform has an easily accessible depth adjustment, provides a firm rest on any surface for smooth, accurate operation. Combined with Model 2GL's 25,000-rpm speed, it achieves its maximum production due to the higher torque of the 4-vane rotary air motor. Equipped with interchangeable templet guides, it can accommodate standard cutters from ⅛ to ⅜ in. in diameter. Motor features a maximum spindle runout of 0.0005.

Doeden Tool Corp, Hicksville, Ohio

MORE DATA? Circle 119, inside back cover

Spot Welding Tip Holder Offered in New Design

Tuffaloy paddle-type holders, designed for welding in confined areas provide cost savings for users because tee connectors are not required Holder comes with standard 4-in. offset and is available in shank diameters of ¾, ⅞, 1, and 1¼ in. It uses Tuffaloy socket-type tips, available in four nose designs. Tips can be inserted on either side of paddle.

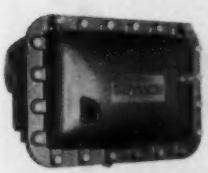
Air Reduction Sales Co, 150 E 42nd St, New York 17, NY

MORE DATA? Circle 120, inside back cover

STALL TORQUE DRILL-SCREWDRIVER-NUTSETTER, Model 410-D, operates at speeds from 1000 to 3000 rpm. Quick-change chuck speeds on-the-job conversion from screwdriver to nutsetter to drill. Screwdriver adapts to all types of screwdriver bits and each unit can be furnished with a variety of keyed chucks to pre-mount drill bits for faster changeover — *Airetool Mfg Co, Springfield, Ohio*

MORE DATA? Circle 121, inside back cover

Alcoa puts the metal where you want it



High-volume output and low cost were the twin objectives. That's why Minneapolis-Honeywell decided its new Process Pressure Transmitter must be housed in an aluminum die casting.

The housing had to be explosion-proof—for it would operate in Class 1, Group D, Division 1 locations. This called for thick walls—especially so for die casting. Mating faces had to meet flush—metal to metal—without gaskets.

These were stiff conditions—demanding a new application of the die-casting process.

Honeywell turned to Alcoa—the company with the most experience in the aluminum industry.

Working closely with Honeywell, Alcoa development engineers designed a die casting that's little short of stupendous. It's made of Alcoa's new high-strength, high-elongation casting alloy 364, which has the properties of alloy 218. Yet, the new alloy is more economical because it is easier to cast.

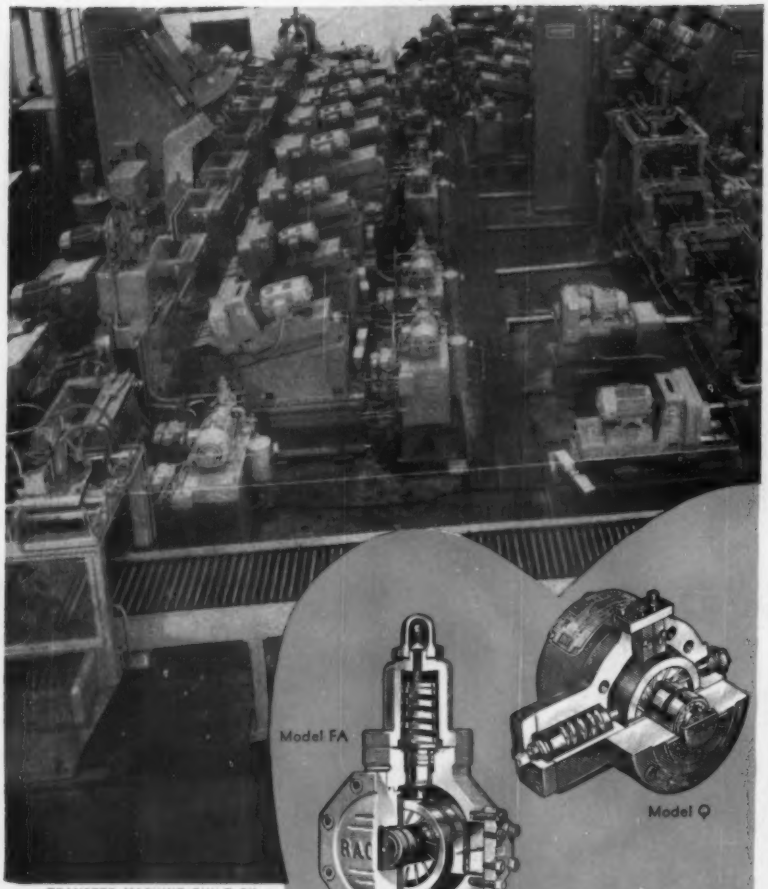
Hydrostatic tests proved that sand-cast prototypes withstand 500 psi, more than enough to assure that castings would withstand explosive pressures up to 125 psi. Mating faces—*as cast*—meet with an integrity that eliminates any need for a gasket.

In castings as well as forgings, impacts, extrusions and screw machine parts, Alcoa puts the metal where you want it. Learn more about Alcoa's ingenious solutions to difficult design problems—write to Aluminum Company of America, 911-M Alcoa Building, Pittsburgh 19, Pa.

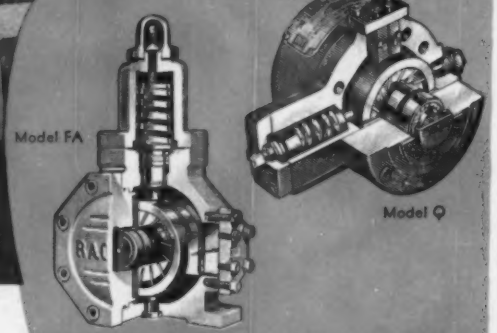
For exciting drama watch ALCOA PRESENTS every Tuesday evening, ABC-TV

ALCOA ALUMINUM

ALUMINUM COMPANY OF AMERICA



TRANSFER MACHINE BUILT BY BUHR MACHINE TOOL CO., ANN ARBOR, MICHIGAN



Automated GIANTS like this

REQUIRE STRONG HYDRAULIC *HEARTS* EVERY MINUTE OF THEIR WORKING LIFE

The precisioned flow control of RACINE PUMPS assures the split-second timing and efficiency required to operate this complex Buhr Transfer Machine . . . custom-built for the completely automatic machining of 120 auto-cylinder heads hourly for a leading automotive manufacturer. Compact RACINE VALVES control feeds and reverse movements on all 323 operations performed by the machine. RACINE 4-WAY SOLENOIDS help one man operate this mechanical giant. Buhr has used RACINE PUMPS and Reservoir Units on custom-built machines for the automotive industry for over 10 years.

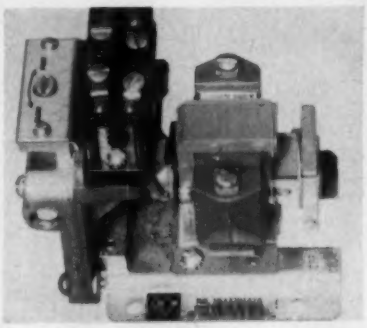
24 RACINE PUMPS

operate this 58 station 500-ton transfer machine

RACINE

Racine Hydraulics & Machinery, Inc.
RACINE, WISCONSIN
HYDRAULICS DIVISION

NEW SHOP EQUIPMENT



ONE-MINUTE PNEUMATIC timing relay has diaphragm assembly which eliminates need for an exhaust valve; diaphragm, made of silicone rubber, will operate dependably in temperatures from 150 to —45 F. Relay's adjustment screw insures positive, accurate adjustment over range from 0.2 to 60 sec—*Cutler-Hammer, 205 N 12th St, Milwaukee, Wis*

MORE DATA? Circle 122, inside back cover

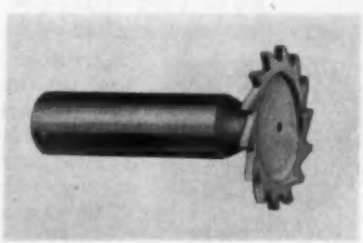
Port Contour Cutters Designed For Machining Hydraulic Fittings

Line of tools has been developed for machining in one pass any of the AND, MS, NAS, and SAE Standards specifications for high pressure hydraulic fittings.

Metcut design features ground form-relieved flutes which are index-notched for easy sharpening.

Metal Cutting Tools Inc, Dept 1061, Rockford, Ill

MORE DATA? Circle 123, inside back cover



WOODRUFF SLOTTING CUTTERS, shank type, narrow width, are available from ½ to 1½-in. dia and widths from 0.020 to 7/32 in., have ½-in. shanks, 2 in. under the head. Cutters are hollow ground for free cutting action. Standard tolerance on width is ±0.001. RH cut is standard—*Quality Tool Works, 322 S Elmwood Ave, Waukegan, Ill*

MORE DATA? Circle 124, inside back cover

OUR
SINCERE
WISH
FOR YOU
AND
YOURS

Happy Holidays

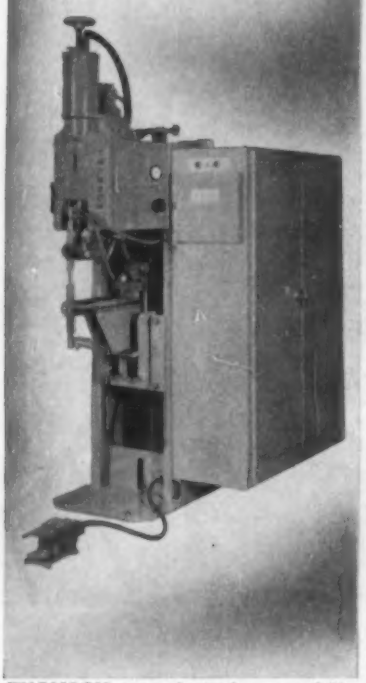
Again the joyous Holiday season rolls around
and with it our warm desire to express
our grateful appreciation to our customers and friends
for their many kindnesses and wish them a
MERRY CHRISTMAS AND HAPPY NEW YEAR.

THE WELDON TOOL COMPANY

3000 Woodhill Road • Cleveland 4, Ohio

OVER
40 YEARS
OF LEADERSHIP
SINCE 1918

The finest
RESISTANCE
Welders
— competitively priced!



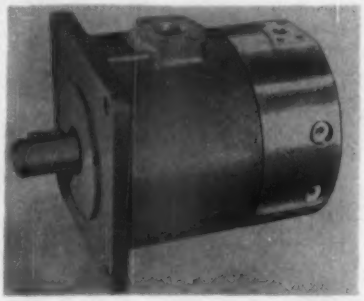
THOMSON manufacturing capabilities have resulted in reduced costs on their resistance welding machines of long recognized quality . . .

SPOT	**PRESS**
PROJECTION	**FLASH-BUTT**
SEAM	**HIGH-FREQUENCY**

For all **AUTOMATED** and **HIGH-PRODUCTION** requirements — either special or standard design — **THOMSON QUALITY** is within your budget. A quote from **THOMSON** will show you how.

Look for our nearest representative in the yellow pages or contact —

Pioneers of Resistance Welding
THOMSON ELECTRIC WELDER COMPANY
161 PLEASANT STREET, LYNN, MASSACHUSETTS
67em 2-7710



90-hp Axial Piston Hydraulic Pump Available in High Pressure Models

Model PF 6033, at an operating speed of 1800 rpm, produces 22 gpm at 6000 psi. Model PF 3046 produces 29.5 gpm at 3000 psi and 1800 rpm. Both feature Split-Flow which permits independent, multiple circuitry using a single pumping unit. Split-Flow resolves problems in synchronizing feeds and speeds in circuits with unequal loads or provides for auxiliary circuit requirements such as full time power brakes. When used for high-low applications, the unloaded pistons circulate oil which aids in cooling the pump during the high pressure operations.

The pump may be operated at speeds up to 2400 rpm maintaining excellent suction characteristics. Ports specifications are optional and mountings and shafts are SAE Standard. Unit is 10½ in. in diameter, 14¾ in. long, weighs 230 lb.

Dynex Inc, 777 Dynex Drive, Pewaukee, Wis

MORE DATA? Circle 125, inside back cover

Knobs and Wheels Offered With Tapped Plastic Threads

Savings ranging from a fraction of a cent to about 2¢ per piece can reportedly be achieved by specifying tapped plastic threads instead of threaded metal inserts in a variety of knobs and handwheels available from Dimco-Gray. In cases where the knob or wheel may be removed from its shaft infrequently or not at all, plastic threads will be both practical and economical, according to the manufacturer. Amount of the saving will depend on the size of the insert normally required and the type of knob involved.

Dimco-Gray Co, 207 E Sixth St, Dayton 2, Ohio

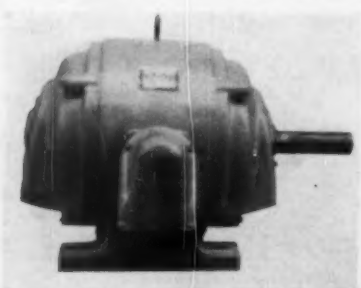
MORE DATA? Circle 126, inside back cover

Air Press Designed to Hold Arc-Fit Notching Attachment

Press is especially built to take the Arc-Fit which notches standard pipe and tubing to form perfect joints for welding and brazing. The attachment, shown in the press, can notch upwards of 1000 pieces per hour. Equipped with the device, the press can notch standard piping up to 2-in. size and tubing up to 2⅜-in. OD.

Vogel Tool & Die Corp, 1825 32nd Ave, Stone Park, Ill

MORE DATA? Circle 127, inside back cover



364U AC DRIP-PROOF MOTOR, 20 to 40 hp, incorporates these shielding features: splash resistant enclosure; bearing cap; labyrinth seal on output shaft; double shielded ball bearings; high dielectric insulation of the winding. Frame is also available with Sterlicone shielding (stator insulation) — *Sterling Electric Motors Inc, 5401 Telegraph Rd, Los Angeles 22, Calif*

MORE DATA, Circle 128, inside back cover

new proven design

NEBEL MICRO-TURN*

HIGH-SPEED PRECISION LATHE

*TM

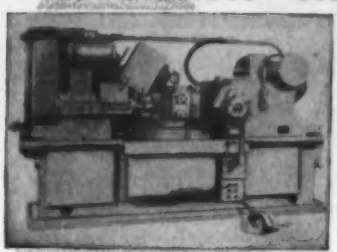
The entirely new Nebel MICRO-TURN Lathe combines the convenience of infinitely variable spindle speeds with the high efficiency of an exclusive new coaxial spindle. Designed around a single shaft surrounded by a planetary gear arrangement, the headstock provides outstanding structural benefits:

- **Low Inertia Effect for quicker acceleration and deceleration, prolonging clutch and brake life**
- **Simplified Alignment with fewer revolving parts for greater smoothness and efficiency of power transmission**

The MICRO-TURN Headstock is composed basically of two sections. The compact back gear unit provides high reduction in minimum space, operates only on low speed range and presents maximum power at the spindle for rated horsepower up to 400 RPM. Above 400 RPM, the coaxial spindle sections lock into a single unit, reducing vibration and insuring a high degree of finish.

For complete details, write today for your copy of the new MICRO-TURN Bulletin No. 219. Nebel Machine Tool Corporation, Lathe Division, 3407 Central Parkway, Cincinnati 25, Ohio

GOSS and DE LEEUW
AUTOMATIC CHUCKING MACHINE



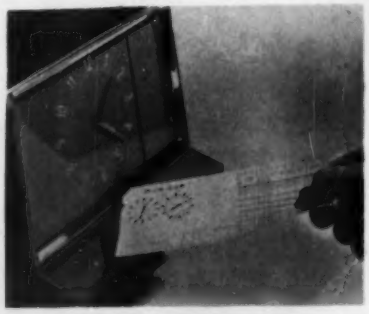
means a complete piece... at each index cycle

When a piece is finished it is *completely* finished without the necessity of a second operation. Furthermore, it means *more* finished pieces in a given period of time and greater accuracy in *every* finished piece.

The "1-2-3" Method is exclusive with Goss & DeLeeuw. With it, three ends of a piece can be machined at a single chucking of the work, simultaneously or in sequence depending on the operations involved. It will pay you to investigate.

Send for illustrated literature giving detailed information. Send samples and ask us to give you cost estimates of handling this work on a "1-2-3" Goss & DeLeeuw Automatic Chucking Machine.

GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.



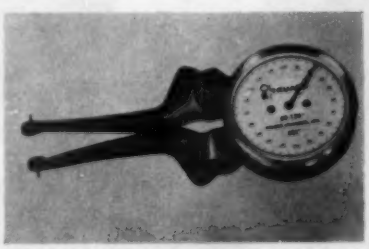
Automatic Elapsed Time Computer Records Machine Utilization Time

Used either for single item computation or as an integral component of any planned or existing cost control system, the Calculagraph automatically computes and simultaneously prints elapsed time, the difference between start time and finish time of a given operation. Programmed by the user to deduct automatically non-working intervals such as overnight idle time or lunch periods, the instrument prints only actual time worked. It can be programmed to fit a particular user's needs and can be engineered to record and print time-and-rate information.

Weight is approximately 16 lb; overall dimensions are 8⅛ x 9 7/16 x 10 19/32 in. It is powered by an electrically driven motor that operates on standard ac current.

Calculagraph Co, 306 Sussex St, Harrison, NJ

MORE DATA? Circle 129, inside back cover



Direct-Reading Dial Gages Measure ID's of Internal Recesses

Line of caliper-type, dial-indicator groove and bore gages is designed to provide an accurate and economical means for measuring the ID of bores and housings, retaining ring grooves, O-ring grooves, and other internal recesses. The instruments are available in four sizes to accommodate diameters from 0.40 to 3.6 in. They are calibrated in graduations of 0.001 or 0.0025 in., depending upon size, and have a reach of 2⅝ in. The gages are equipped with replaceable

New MODEL 50 equips your lathes to do a lot more for a lot less!

$70.00 for the chuck

$65.00 for the collets

THE WORLD'S MOST MODERN COLLET CHUCK

Designed expressly for ATLAS, CLAUSING, DELTA, LOGAN, SHELDON, and SOUTH BEND LATHES

These and others of similar power and capacity now give top performance when equipped with the new Jacobs Model 50. Improve performance of your lathes. Increase spindle capacity as much as 42%. Get greater accuracy and stronger grip. It's easy and inexpensive with new Model 50 and its companion Rubber-Flex collets.

CONSIDER THESE FEATURES . . .

- **Gripping Power**
  Model 50 is made for heavy duty turning. It has tremendous gripping power.
- **Accuracy**
  Model 50 is factory tested—maximum runout .001" T.I.R. at the nose when properly mounted.
- **Thin Walled and Fragile Work**
  Always parallel Model 50 Rubber-Flex collet jaws permit chucking of tubing and fragile materials without crimping or scoring.
- **Range**
  The 10 Rubber-Flex collets in the 500 Series, developed especially for use with Model 50, cover a greater bar stock range than 63 old-fashioned steel collets. You can chuck any bar between 3/32" and 1-1/16" with this set of 10 collets.
- **Capacity**
  Model 50 eliminates capacity-wasting draw bar. You can increase spindle capacity up to 42%.
- **Adapters**
  Model 50 adapters are fully machined for immediate mounting. Available in all popular threads and American Standard L00 taper.
- **Price**
  Model 50 prices are revolutionary!
  $70.00 for the chuck.
  $65.00 for the complete set of 10 collets.

MODERNIZE YOUR LATHES WITH JACOBS MODEL 50 AND RUBBER-FLEX COLLETS. YOU CAN'T AFFORD NOT TO!

See your Jacobs industrial supply distributor. Give him the opportunity to prove these fantastic facts with a convincing demonstration at your desk! Call him today.

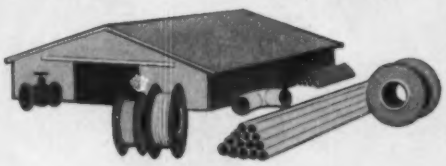
Jacobs CHUCKS

The Jacobs Manufacturing Co., West Hartford 10, Conn.

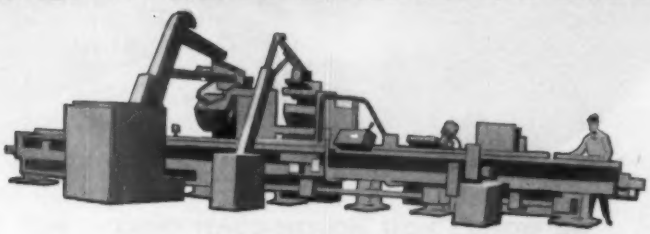
NOW...

a new, low cost method to

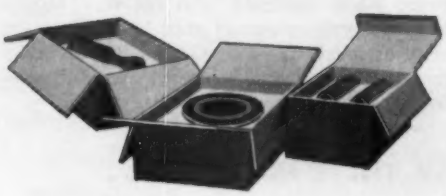
DURING STORAGE



DURING PRODUCTION



IN PACKAGING



NEW! CRC soft-seal

LONG TERM PROTECTION AGAINST SURFACE CORROSION

Providing longer lasting protection, SOFT-SEAL is recommended for surfaces exposed to the weather, for protection of ducts carrying corrosive fumes and other extreme applications.

If you are using expensive interior storage space for metal stocks, dies, jigs and fixtures, these may be coated with SOFT-SEAL and stored outside to release inside space for productive use.

SOFT-SEAL forms a continuous protective film up to 8 microns thick. The film can be applied by spraying or dipping. It never becomes hard or brittle and will not crack or craze. When necessary, SOFT-SEAL is easily removed at low cost with live steam, detergents or solvents.

CRC®

prevent rust and corrosion

CRC FORMULA 3-36 FOR THE METALS INDUSTRY

CRC 3-36 eliminates corrosion by dual action. First, by separating moisture from the metal surface; second, by sealing the surface against the re-entry of moisture and corrosive atmospheres.

Because CRC 3-36 has high capillary action and extremely low surface tension, it spreads over surfaces, penetrates and clings to grain boundaries, pores, scratches and cracks. Instead of trapping moisture against the surface and thus assuring corrosion, CRC 3-36 displaces any moisture present on the surface and forms an effective barrier against subsequent deposits of water by condensation or other means. It has a preferential affinity for metals and forms a continuous molecular film of approximately 2 microns. This film never becomes hard or brittle and will not crack or craze.

CRC 3-36 prevents intergranular corrosive action and insulates dissimilar metals to prevent electrolysis. It is effective on painted and plated surfaces which are inherently porous, preventing minute sub-surface corrosion which leads to complete failure.

Not only does CRC 3-36 prevent corrosion from forming, but it penetrates any scale formation and breaks the interfacial tension that binds corroded parts. It acts quickly, freeing corroded threads on studs, nuts and bolts, etc. and on normally rotating or sliding parts such as hinge pins and bearings. CRC 3-36 prevents fingerprint corrosion, aids cleaning and has a beneficial lubricating effect on moving parts.

Whether your control of rust and corrosion is related to storage of metal stocks, in-process material or equipment, packaging or shipping, CRC 3-36 does an effective job and saves its cost many times over by eliminating downtime due to corrosion and by preventing deterioration of tools, instruments, dies, fixtures, jigs and precision-machined surfaces.

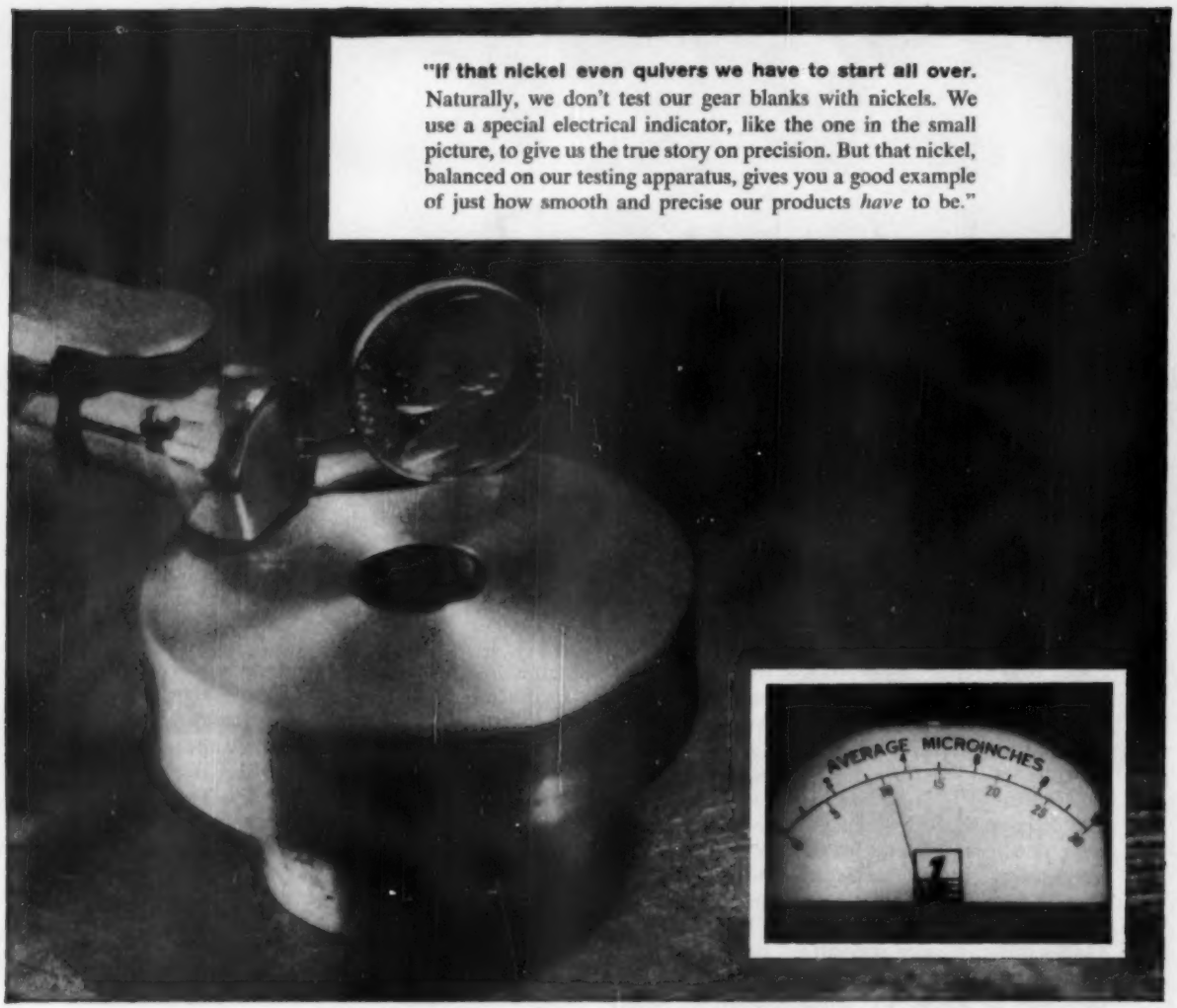
Applied by spraying or dipping, CRC 3-36 is less expensive, quicker and more effective than wax dipping, chrome plating, lacquering or similar treatments. Additional savings are possible because CRC 3-36 does not have to be removed before subsequent machining operations, welding or painting. It is economical to use because, forming a very thin film, a small quantity covers a very large area.

Investigate today: Write for complete information to:

CORROSION REACTION CONSULTANTS
A subsidiary of the Chas. J. Webb Sons Co., Inc.
116 D Chestnut St., Philadelphia 6, Pa., WAlnut 5-0200

3-36 RUST AND CORROSION PREVENTION PROGRAMS

Call your local industrial supply distributor for a trial order


"If that nickel even quivers we have to start all over.
Naturally, we don't test our gear blanks with nickels. We use a special electrical indicator, like the one in the small picture, to give us the true story on precision. But that nickel, balanced on our testing apparatus, gives you a good example of just how smooth and precise our products *have* to be."
AVERAGE MICROINCHES

"We depend on Cities Service for absolute precision!"

Lester E. Hoffmann, Treasurer and Vice-President
American Screw Machine Products Co., Chicago, Ill.

"The screw machine business is a highly competitive trade. We've built our business and our reputation on top quality, high-precision products . . . gear blanks that require the closest tolerances in *all* aspects. That means *we have to have* the best-quality cutting oil available. We've depended on Cities Service for nearly 25 years and they've never let us down."

"Matter of fact," says Mr. Hoffmann, "they insisted we try other brands just to prove that Cities Service was the best for us. They proved their point. We've stuck with Cities Service."

At the present time, American Screw Machine Products Co. is using Cities Service CHILLO 10 Cutting oil, and some CHILLO 22. As Mr. Hoffmann says, "The sulphur and chlorine additives prevent welding and galling action which allows for fine finishes and long tool life that maintains high-precision, top-quality work."

If you use petroleum products in your operations, why not talk with your Cities Service Lubrication Engineer? He can help you get the most from your operations by giving you the finest products, the best service available. Or if you prefer, write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

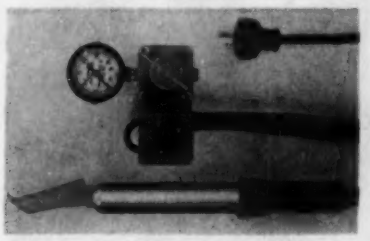
CITIES SERVICE
QUALITY PETROLEUM PRODUCTS

needle-type contact points.

Price of the gage is $35, including standard contact points, an angled screwdriver for adjusting the points, and a fitted wooden case.

Truarc Retaining Rings Div of Waldes Kohinoor Inc, 47-16 Austel Pl, Long Island City 1, NY

MORE DATA? Circle 130, inside back cover



All-Purpose Hand Welder Developed for Thermoplastics

Model 12-AW for welding and tacking thermoplastics such as polyethylene, polypropylene, PVC, and plasticized tank lining, can be used for both shop and field work with a high-speed production rate of up to 60 ipm.

Constant flow of high-temperature air is maintained through specially designed tips suited to the type of welding necessary. Supplied with a tacker tip and one round tip, it has a 3-heat metal heat element with an output of up to 800 w. Stainless steel barrel encloses the heating element. A metal-cased rotary switch (three heat positions, one Off position), a pressure gage, and an airflow regulator are also included. Each welder is furnished with a 16-ft neoprene air hose that terminates in an air-cooled handle. Unit can be plugged into any 115-v ac outlet.

Kamlar Products Co, 932R Washington St, Norwood, Mass

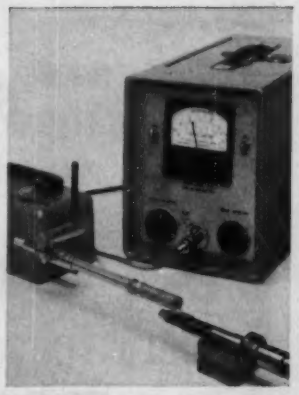
MORE DATA? Circle 131, inside back cover

TWO NEW SERIES of 90° angle-head fastening tools for air-powered nutrunning and screwdriving have adjustable clutches for closer torque regulation. Designed for continuous industrial operation where clearance is limited to ½-in. offset, tools feature spring-loaded clutch with torque output adjusted by tamper-proof hex nut—*Buckeye Tool Corp, 5003 Springboro Pike, Dayton 1, Ohio*

MORE DATA? Circle 132, inside back cover

Here's the latest inspection equipment

. . . FOR SURFACE MEASUREMENT



PROFILOMETER® — Measures the roughness of practically *all* machined and finished surfaces, internal and external, in microinches (arithmetical or r.m.s. average height). Fast; dependable; easy to use.

PROFICORDER® — Draws magnified profile of internal and external surfaces, showing absolute deviation from flatness or roundness. Chart shows *roughness* only, *waviness* only, or *total profile*, as desired; permits measuring height, width and spacing of waves, bows, steps, roughness and other irregularities.

MICROCORDER® — Draws magnified profile of internal and external surfaces along straight path of trace. Chart shows pits, pores, scratches, chatter marks and similar irregularities in detail.

WAVOMETER® — Measures the microinch height of waviness irregularities (r.m.s. average) around internal and external surfaces of rotation on a production basis.

The Profilometer, Proficorder and Microcorder are used on metals, paper, plastics, ceramics and many other materials.

. . . FOR MEASURING RUNOUT

VAROMETER® — Measures runout of spindles, shafts, wheels etc. while the parts are rotating. Also used for surface analysis.

. . . FOR TESTING BALL BEARINGS

ANDEROMETER® — Measures the characteristics of assembled ball bearings that result in noise and vibration, in production and receiving inspection. Enables bearing users to write *numerical specifications* (in Anderons) for overall quality of ball bearings.

WRITE FOR LITERATURE on items of interest.

MICROMETRICAL MMC® MANUFACTURING COMPANY
3621 E. STATE RD. ANN ARBOR 1, MICHIGAN

MANUFACTURER OF THE PROFILOMETER® • PROFICORDER® • MICROCORDER® WAVOMETER® • ANDEROMETER® • VAROMETER®

Proudly Serving

AMERICA'S LEADING MANUFACTURERS

for over 40 years

WYCKOFF

COLD FINISHED STEEL BARS

SERVICE CENTERS

APPLIANCES

SCREW MACHINE INDUSTRY

CONSTRUCTION

AUTOMOTIVE

RAILROADS

FASTENERS

ORDNANCE

AIRCRAFT

AGRICULTURAL

ELECTRICAL

MACHINE TOOLS

Over the years, Wyckoff production facilities have kept pace with the most exacting requirements of all specifications involving: optimum machining properties . . . accuracy . . . outstanding finish . . . controlled physical properties through diversified furnace treatments. For the finest in cold finished steels—SAVE —specify WYCKOFF.

WYCKOFF STEEL COMPANY

GENERAL OFFICES: Gateway Center, Pittsburgh 30, Pa.

Branch Offices in Principal Cities

Works: Ambridge, Pa., Chicago, Ill., Newark, N. J., Putnam, Conn.

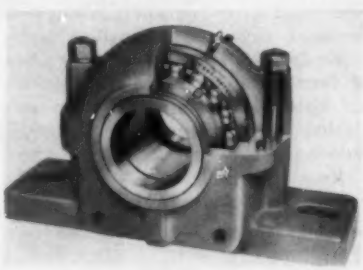
Clamp-N-Jack Set-Up System Available in Smaller Version

New B Series is similar in design to the original A Series except that all components are smaller, making the series adaptable for clamping and jacking.

Components consist of swivel bases and strap clamps that are assembled together to provide an infinitely adjustable support for the clamp. Also included are spacer tubes that allow for additional clamping heights when assembled with the swivel bases and spacer tubes. Tubes and swivel bases can be used in conjunction with a special base making an adjustable jack for work support. Series is available in complete sets or as individual components.

Universal Vise & Tool Co, Parma, Mich

MORE DATA? Circle 133, inside back cover



Line of Heavy-Duty Pillow Blocks Available in 143 Sizes

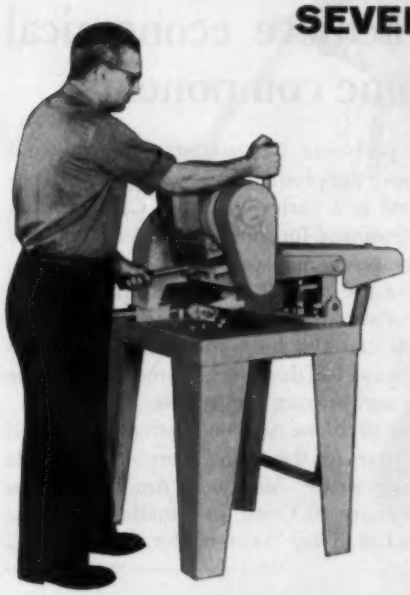
Two heavy-duty series with self-aligning spherical roller bearings in split housings are offered: Series SAF with two bolts clamping cap to base, and Series SDAF with heavier castings and four cap bolts. All sizes are available with straight bore bearings for shouldered shaft mounting or with adapter bearings suitable for mounting on straight commercial shafting.

Torrington Co, Bantam Bearings Div, South Bend 21, Ind

MORE DATA? Circle 134, inside back cover

12 seconds per cut on this 2-inch steel bar!

SEVER-ALL MODEL 1-A gives high-quality cuts at low cost



Even the newest super alloys can be cut at 3 to 6 seconds per square inch on the Sever-All Model 1-A dry abrasive cutting machine. The burn-free slices of hardened steel shown above are typical of the cuts you'll get on almost any metal. *You get this speed and quality for an investment of approximately $500!*

You get big capacity, too, with the Model 1-A—up to 2" square solids, 3½" O.D. pipe and tubing, 3" angle iron and 4" channels. You can cut practically any metal. On top of that, wheel oscillation—an "exclusive" in this price range—provides cooler cutting, longer wheel life.

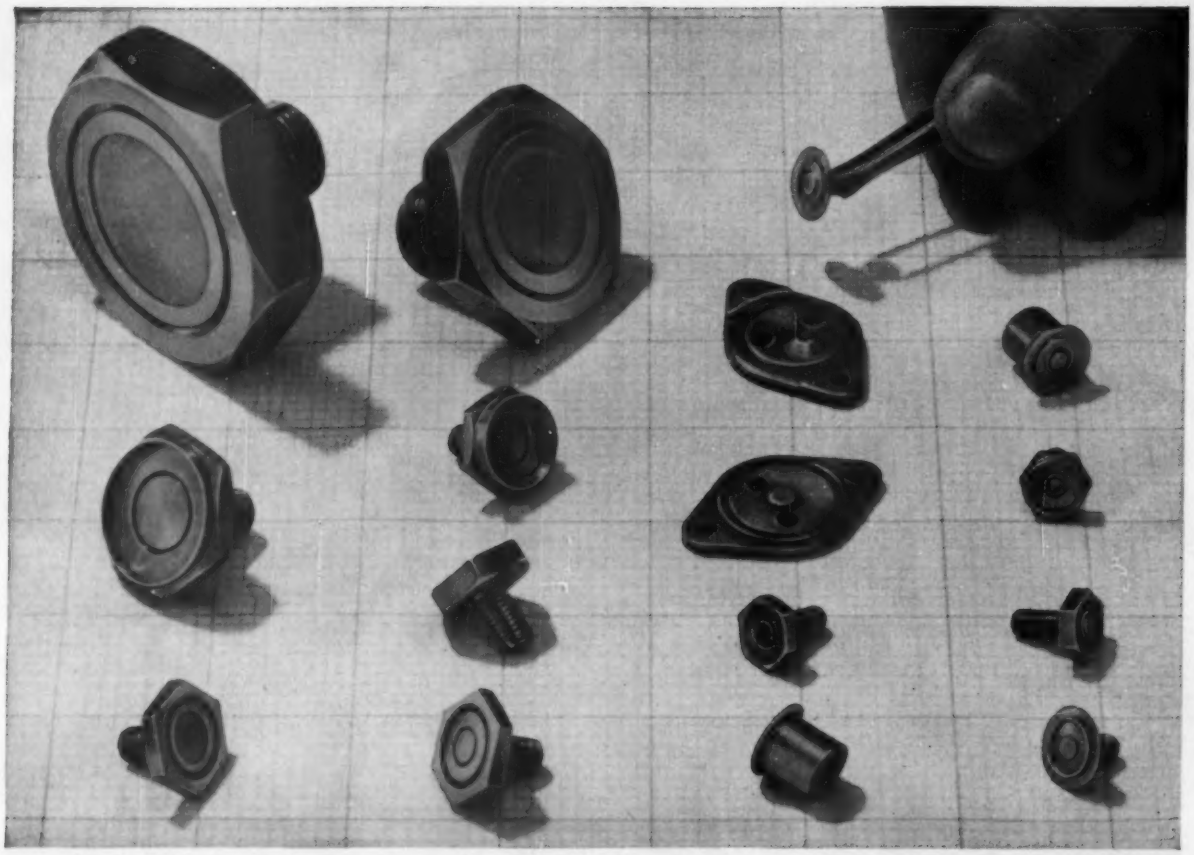
The Model 1-A is so easy to use, too. Wheel selection is simple—just two types of wheels do *all* your Sever-All cutting jobs. Minimum set-up time required.

You can get immediate delivery from your Sever-All distributor. *Write* us for his name — or ask for **Bulletin DH-106** for details on the Sever-All Model 1-A.

SEVER-ALL ABRASIVE CUTTING MACHINES

ACCO

Allison-Campbell Division • American Chain & Cable Company, Inc.
923 Connecticut Avenue, Bridgeport 2, Conn.



SEMICONDUCTOR BASES

These Anaconda coppers help you achieve economical volume production of essential electronic components.

As the use of semiconductor devices soars, production methods must be geared to economical volume production, and the selection of metal for the bases becomes critical. Electrolytic Tough Pitch (ETP) Copper has the high electrical and thermal conductivity required, but the severe heat cycling encountered in degassing and brazing the devices during manufacture limits its use. The copper alloy must be deoxidized or oxygen-free to resist hydrogen embrittlement. For secondary operations, it must also have good machinability. And where high torque is used to tighten the base to the heat sink, it must in addition have relatively high strength.

COPPER METALS. Various combinations of the desired properties are found in these Anaconda alloys: DLP Copper-104 (deoxidized low phosphorous), OFHC* Copper-120 (oxygen-free high-conductivity), Tellurium Copper-127, Chromium Copper-999, and Amzirc* (Zirconium Copper)-134.

FABRICATING METHODS. Anaconda specialists can help you select the right alloy and form of metal—and the manufacturing method best suited to meet your design and fabrication problems. Depending on the size and design of the base, the production runs involved, parts may be produced in a variety of ways. Cold heading may be most economical for some, others might be die-pressed forgings, screw machine or punch-press parts. And for many of the smaller parts, multiple-plunger-press fabrication could offer the greatest economies. These specialists can also help you utilize such cost-cutting techniques as roll threading of studs, and advise you on welding and brazing procedures.

Whatever your problem, Anaconda offers specialized technical help—yours for the asking. See your Anaconda representative or write: Anaconda American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 6075

*Trade-mark of American Metal Climax, Inc.

ANACONDA®

COPPER PRODUCTS FOR THE ELECTRICAL INDUSTRY

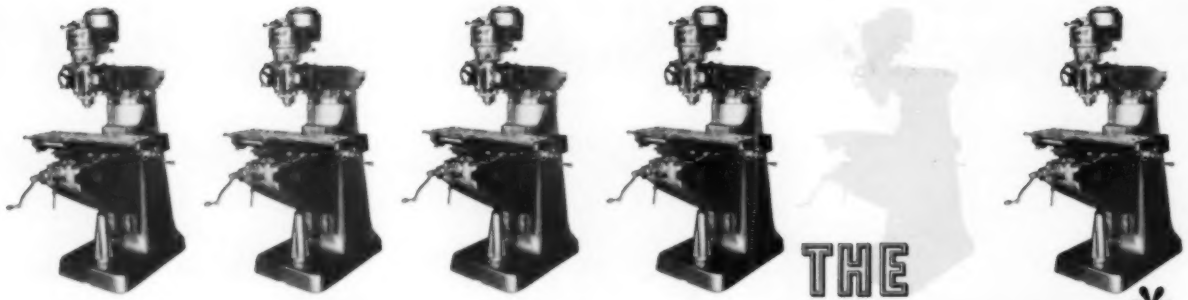
Anaconda American Brass Company

Bridgeport's 50,000th *"Anniversary"*

Our "Anniversary"
is measured
in production -- not time.
This 50,000th
Bridgeport Turret
Milling Machine,
completed on July 6, 1960,
was finished in gold
to commemorate
the occasion.

Cost . . . Versatility . . . Reliability
These are the factors influencing
the decision to purchase a
machine tool. 50,000 decisions
favored Bridgeport Millers . . .
"THE MOST FOR THE LEAST"

Bridgeport® MACHINES, INC.
Bridgeport, Connecticut
Manufacturers of High Speed Milling Attachments and Turret Milling Machines



THE GOLD PLATED* MILLING MACHINE

Completion of the 50,000th Bridgeport Turret Milling Machine, earlier this year, set an international record for production of a single machine tool.

There is more to this outstanding achievement than mere statistics would indicate.

There is the story of a company which stands as proof-positive that American know-how, inventiveness and craftsmanship can produce a machine that has become an integral part of the language of metalworking throughout the world.

This is testimony, also, to the accomplishments made possible by a free economy.

The companies whose products and services contribute to the manufacture of the Bridgeport Miller are proud of the continuing parts we play in the building of this world renowned machine. Its requirement for perfection in every detail has heightened the standards for quality and workmanship to which our products are made.

IN RECOGNITION

MACHINE HANDLES AND BALANCED CRANKS
Balcrank, Incorporated
Cincinnati, Ohio

LUBRICATING SYSTEMS FOR MACHINE TOOLS
Bijur Lubricating Corporation
Rochelle Park, New Jersey

QUILL MASTER & QRA ATTACHMENTS
Custom Machine & Tool Company
Clifton, New Jersey

INDUSTRIAL PAINTS & LACQUERS
C. W. Haynes Laboratories
Springfield, Massachusetts

STEEL SERVICE CENTER
Edgcomb Steel of New England, Incorporated
Milford, Connecticut

BALL BEARINGS
Fafnir Bearing Company
New Britain, Connecticut

ELECTRIC MOTORS
Fairbanks, Morse & Co.
Freeport, Illinois

GEARS
Grant Gear Works, Inc.
Boston, Massachusetts

PRECISION BALL, ROLLER & THRUST BEARINGS
Norma-Hoffman Bearings Corporation
Stamford, Connecticut

ALUMINUM CASTINGS AND DIE CASTINGS
Peerless Aluminum Foundry
Bridgeport, Connecticut

CHROME PLATED WAYS FOR MACHINE TOOLS
The Superior Plating Company
Fairfield, Connecticut

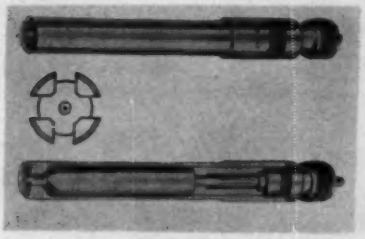
CASTINGS
The Producto Machine Company
Bridgeport, Connecticut

PRECISION MACHINE TOOL CONTROLS
True-Trace Corporation
El Monte, California

ELECTRICAL MOTORS
U.S. Electrical Motors, Incorporated
Milford, Connecticut

OPTICAL MEASURING INSTRUMENTS
Veriscope Corporation
New York, New York

*The 50,000th Bridgeport Miller was finished in "gold" to commemorate its manufacture.



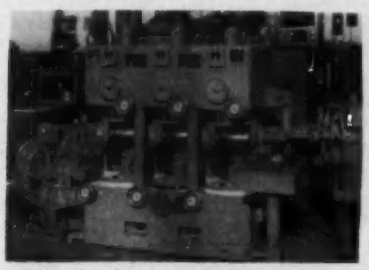
Kelly Expanding Transfer Punches Assure True-Center Accuracy

Through the expanding feature, a set of three Kelly Tru-Center punches has a size diameter range from ¼ to 11/16 in. With transfer accuracy desired in thousandths the three punches actually cover a range of 437 thousandths.

In use, a punch is inserted in the drilled hole which is within the range of the punch size. By turning the knurled head the bottom of the punch body is expanded to a perfect fit in the bottom of the hole. A hammer stroke on the top of the center pin secures the desired true-center mark. The punch is removed by reversing the knurled nut and retracting the expanded body. The No. 300 Kelly punch set is furnished in three sizes: No. 301, ¼ to 5/16 in.; No. 302, 5/16 to 7/16 in.; No. 303, 7/16 to 11/16 in. Price, in hardwood pocket size case, is $16.75.

Kelly Tool & Mfg Co, 3408 Monterey Rd, Los Angeles 32, Calif

MORE DATA? Circle 135, inside back cover



Tube and Bar Straightener Takes Sizes From ⅛ to ½-in. dia

Model VRN-000 with vertical straightening rolls manufactured by Kieserling & Albrecht, Germany, is especially designed for tubing with thin walls and where special surface finish is required.

Machine, which will also straighten the ends of the tubing, comes equipped with three straightening speeds. All three roller pairs are motor-driven.

Dist by Straus-Artys Corps, 45 N Station Plaza, Great Neck, NY

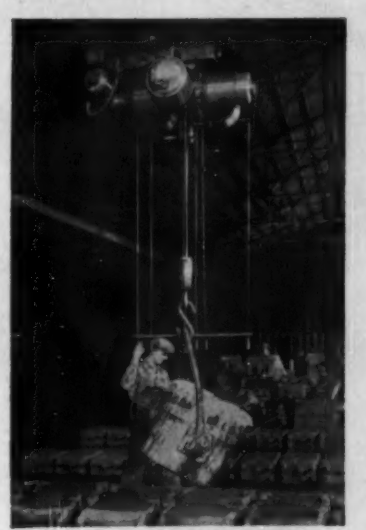
MORE DATA? Circle 136, inside back cover

SHEPARD NILES

HOISTS

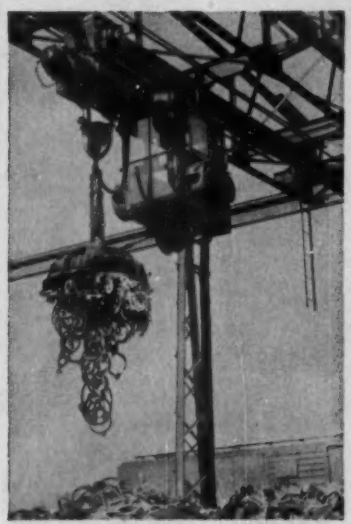
CUT HANDLING COSTS

in YOUR plant with the right hoist



FLOOR-OPERATED HOIST

Operator primarily occupied with other duties, uses hoist for fast, efficient short hauls.

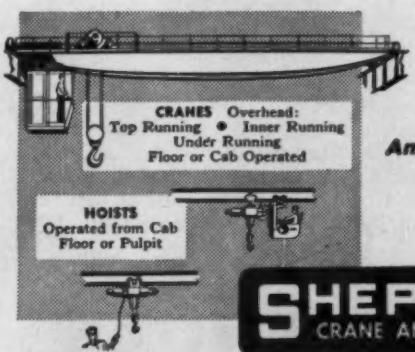


CAB-OPERATED HOIST

Cab operator moves loads at high speeds, can quickly spot material for handling.

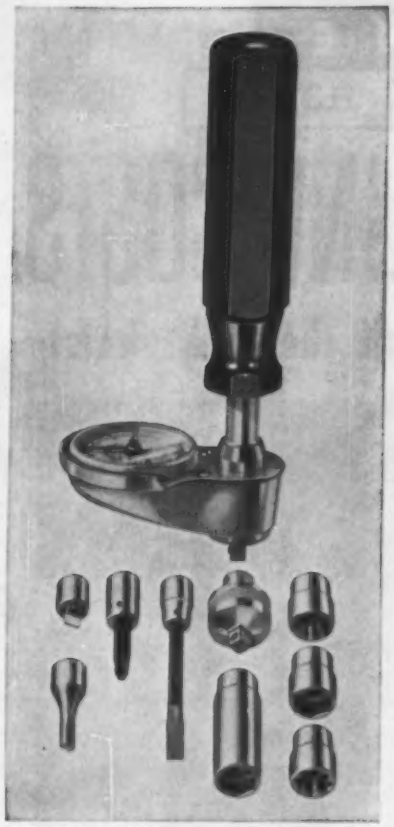
WHICH Shepard Niles hoist fits your plant's needs . . . a floor-operated hoist where the operator is freed for other duties or a cab-operated hoist where the operator is engaged full time moving loads through the air? Shepard Niles manufactures both types in capacities from 1 to 20 tons.

Send for the descriptive bulletins on both Cab and Floor Operated Hoists . . . or ask that a Shepard Niles representative call — there's NO OBLIGATION.



Building
America's Most Complete Line of Cranes and Hoists
Since 1903

SHEPARD NILES
CRANE AND HOIST CORPORATION
3195 Schuyler Ave., Montour Falls, N.Y.



BE SURE

of correct screw or bolt tension with

Snap-on Torque Driver

SNAP-ON torque drivers are available in three models with attachments to handle a wide range of jobs.

Model TQS-025 — Capacity: 3 in-lb and 48 in-oz
Model TQS-050 — Capacity: 6 in-lb and 96 in-oz
Model TQS-1 — Capacity: 12 in-lb and 192 in-oz

for Aviation - Electronics - Radio - Television - Radar . . . any precision assembly work

This ¼-inch drive SNAP-ON torque driver gives you precise control on jobs where screws or nuts must be tightened to exact tensions. Unit is extremely accurate, regardless of position, or manner of holding.

Easily read dial is calibrated in inch-ounces and inch-pounds and may be adjusted right or left for convenient use. Dial can be used two ways. Either set pointer at desired bolt tension and apply turning pressure to screw or nut until pointer reaches zero, or set pointer at zero and apply pressure until pointer reaches desired calibration on scale.

Available with variety of ¼-inch drive attachments

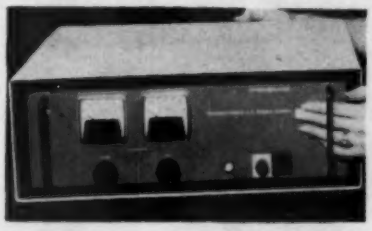
Standard screwdrivers — 3¼" long: 3/16"x.032", ¼"x.032", and 3/8"x.042" tips
Short screwdrivers — 7/8" long: ¼"x.032" tip
Clutch-type screwdrivers — 1 3/8" long: 11/64", 13/64" and 5/32" bit diameter
Phillips screwdrivers — No. 1 and No. 2 bits in various lengths
Single hex sockets — 9 sizes, 3/16" to ½"
Deep single hex sockets — 9 sizes, 3/16" to ½"
Double hex sockets — 8 sizes, 3/16" to ½"
Double square sockets — 3 sizes, ¼" to 3/8"
Extensions, ratchet adapters, etc.

A SNAP-ON Sales Engineer can give you more information on the value of torque drivers and TORQOMETERS® in your production or maintenance work. Well-stocked SNAP-ON Branches are located in every major industrial area. Check your phone book or write us for complete catalog listing the full range of wrenches and hand tools.

FOR ALL INDUSTRY

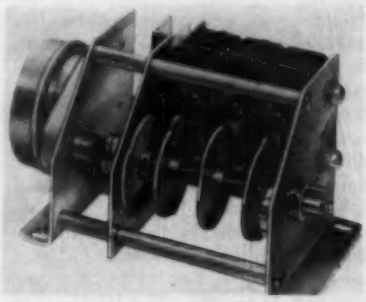
SNAP-ON TOOLS

8025-L 28th AVENUE • KENOSHA, WISCONSIN



TRANSISTORIZED DC POWER supplies, in a line of more than 30 standard designs, has output voltages which range from 1.5 to 100 volts. Supplies have convection-cooling and "constant watts" circuit for protection against overloads and short-circuits — *General Electric Co, Schenectady 5, N Y*

MORE DATA? Circle 137, inside back cover



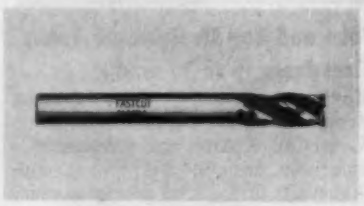
Program Cam Timer Features External Clutch, Automatic Reset

Series 650 is a multi-switch cam timer designed for the OEM. External clutch permits instant automatic reset regardless of time cycle.

Any time cycle from 1 second to 60 hours can be specified. From two to five load switches are available and the Series 650 is also offered with adjustable or preset cut cams. Prices range from $25.50 to $43.50.

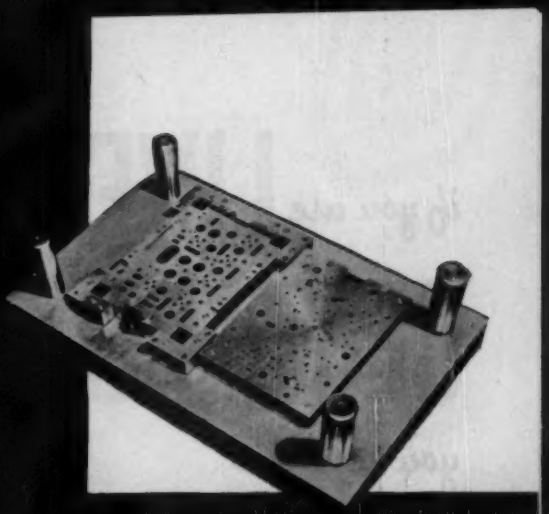
Industrial Timer Corp, 1407 McCarter Highway, Newark 4, NJ

MORE DATA? Circle 138, inside back cover



MINIATURE END MILLS (designated as 3/16-in. shank), are made of HSS with hollow ground spiral flutes. Diameters range in 1/64-in. increments from 3/64 to 3/16 in. Types include single-end, double-end, single-end ball, and double-end ball—*Fastcut Tool Co, 25425 Mound Rd, PO Box 395, Warren, Mich*

MORE DATA? Circle 139, inside back cover



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order after order after order... minimum size change and distortion... low temperature heat treating... uniform deep hardenability... freedom from scaling... good machinability... exceptional toughness with good hardness... no preheating in hardening. From start to finish you enjoy exceptional simplicity and safety and predictable performance. Produced by the MEL-TROL® Process... Only Carpenter VEGA-FM assures such uniformity of benefits. Use this MATCHED SET of Air-Hardening Tool and Die Steels—VEGA-FM (Type A-6), No. 484-FM (Type A-2), and No. 610-FM (Type D-2)—for proper selection and consistently better results. Call your Carpenter SERVICE-CENTER for prompt delivery.

Carpenter **steel**

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Alloy Tube Division, Union, N. J.
Webb Wire Division, New Brunswick, N. J.
Carpenter Steel of New England, Inc., Bridgeport, Conn.

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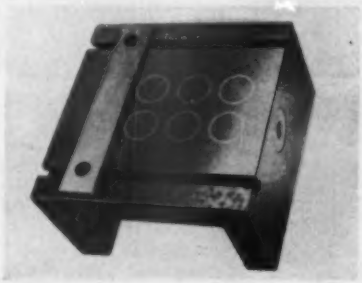


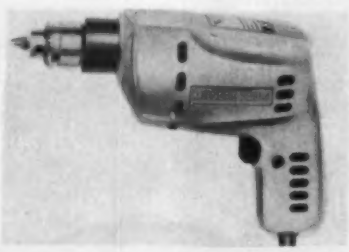
Magnetic Angle Plate Can Be Used Without Clamps

Inspection and layout of any ferrous metal is possible on the new plate without the use of clamps. Dimensions are 6 x 6 x 4 in. and the plate is guaranteed to be square within 0.0002 in.

An adjustable guide rail, supported in two T-slots, may be used as a reference or support and can be removed completely. The permanent magnetic chuck, which does not create magnetic distortion, is activated by a key. Price is $155.

Bald Eagle Products Co, 60 E Fourth St, St Paul 1, Minn

MORE DATA? Circle 140, inside back cover



Drill Has Nylon Housing And Insulated Chuck

No. 1144 double-insulated ¼-in. Safe-T-Drill is reported to be 20% lighter than comparable aluminum drills. In addition, it can serve as the power unit for a complete 14-tool power workshop with a motor rated at 2.7 amp. Price is $24.95.

Millers Falls Co, Greenfield, Mass

MORE DATA? Circle 141, inside back cover

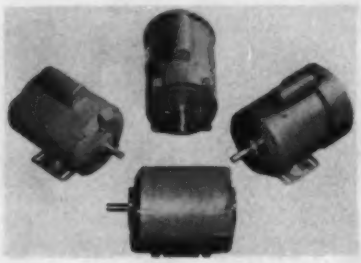
Kwik-Size 3-in-1 Boring Tools Offered in Enlarged Line

Designed to speed boring operations by eliminating the need for different tools for roughing, semi-finishing, and finishing, these tools are available in 18 sizes for boring holes in ranges from 3 to 13¼ in.

The tool carries three standard square cutters in a single indexable head. Cutter head is mounted eccentrically on an arbor so that only one tool is in cutting position and the other two are clear of the bore.

Davis Div, Giddings & Lewis Machine Tool Co, Fond du Lac, Wis

MORE DATA? Circle 142, inside back cover

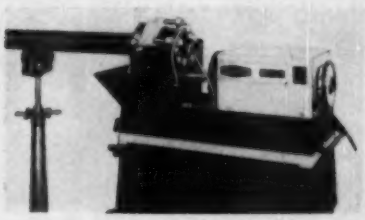


Reliance Electric Offers New Line Of Fractional Horsepower Motors

Duty Master line of ac motors is available in 1/20, 1/12, ⅛, 1/6, ¼, 1/3, ½, and ¾-hp ratings. Capacitor-start, split-phase, and polyphase units are made in frame sizes 48 and 56; repulsion-start induction-run models come in frame size 56. Open protected; totally enclosed, fan-cooled; totally enclosed, non-ventilated; and explosion-proof enclosures may be specified as well as either ball or sleeve bearings.

Reliance Electric & Engineering Co, 24701 Euclid Ave, Cleveland 17, Ohio

MORE DATA? Circle 143, inside back cover



Geared Die-Stock Unit Converts 2-in. Pipe Machine to 4-in.

Geared die-stock adaptation for threading up to 4-in. pipe is designed primarily for use with the present Oster No. 552 complete pipe machine but can easily be adapted to practically any existing Oster 2-in. machine now in the field.

The unit consists of a special tool support which slides on the bedways of the machine after the standard carriage on the No. 552 is removed. The 4-in. die-stock is supported on two sides of the carriage and is driven by a short drive-shaft from the chuck of the machine.

Oster Mfg Co, 1340 E 289th St, Wickliffe, Ohio

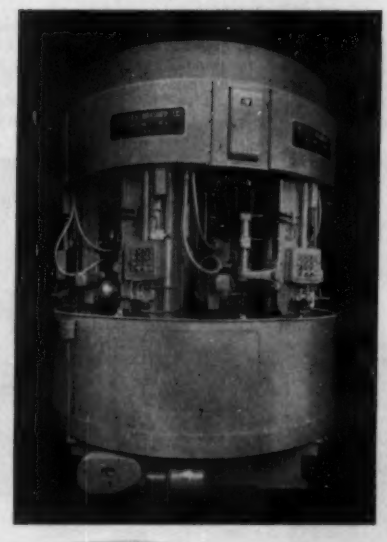
MORE DATA? Circle 144, inside back cover

How long is it

FROM GOLDEN OPPORTUNITY...

50

TO GOLDEN ANNIVERSARY ?



Time-wise it is fifty years. Fifty of the most exciting, progressive years in our nation's history.

From a technical standpoint it appears much longer, so tremendous are the changes that have been wrought in the machine tools of today vs. those of yesteryear.

Men of vision incorporated the Lees-Bradner Company in October of 1909. They recognized the need for better cutting machines and grasped their golden opportunity to improve gear generating methods. Men of vision have carried on ever since, perfecting those early machines and winning for Lees-Bradner the most respected position in the hobbing machine industry.

Yes, we're fifty years young—and growing younger every year with fresh, new ideas that multiply the efficiency of Lees-Bradner machines.

Many thanks to our thousands of good customers who, years ago and since, gave us the "golden opportunity" to reach this, our "golden anniversary."

IMPROVING GEARS... FOR 50 YEARS!

the LEES-BRADNER *Company*

CLEVELAND 11, OHIO, U.S.A.

Continuous Full Rated Capacity means BIGGER dollar for dollar VALUE!

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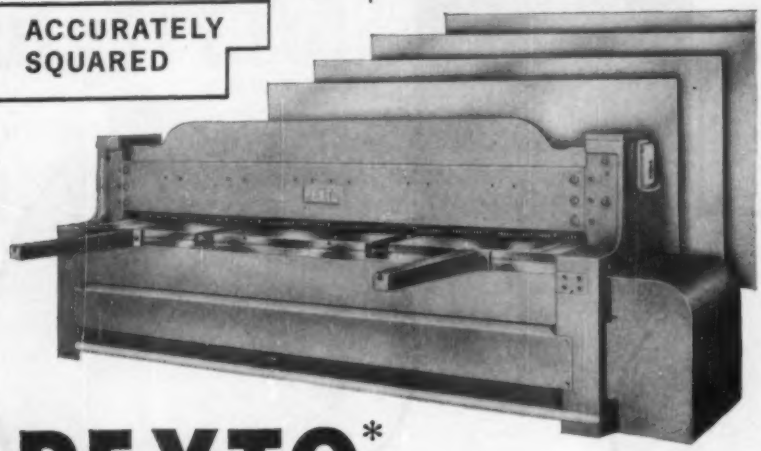

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A complete line

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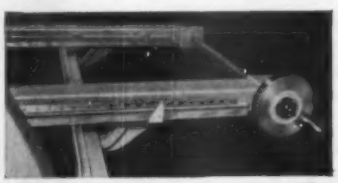
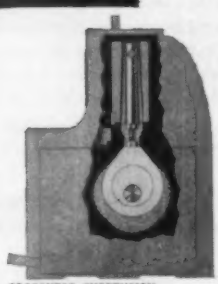
PEXTO Power Squaring Shears have design features that provide unparalleled full capacity shearing with squaring accuracy, delivering top production all day, every day . . . even at full-rated capacity.
These world famous Squaring Shears are built from heavy, high-grade machine tool castings, and have self-compensating holddowns, precision gauging with maximum cutting-life from four edged blades.
These are but a few of the important features PEXTO Power Squaring Shears offer. Write for the latest literature.

STANDARD BACK GAUGE
NEW improved design. PEXTO has added a new measure of precision, with fast, self-reading dial setting. Gauge can be locked in any position. Graduated in 128ths of an inch.



GEAR TRAIN
Double reduction gearing through modern 20° pressure angle steel pinions and cast gears provides smooth power transmission.

DRIVE
Higher flywheel speed and Timken bearings add accuracy and smoothness. Motor base can be adjusted in seconds.



CROSSHEAD SUSPENSION
A unique method of mounting means efficient use of power and effective reduction of side-thrust and wear.

Pexto Squaring Shears are sold through Dealers and Distributors . . . Send for Bulletins 57 and 60.

THE PECK, STOW & WILCOX CO. Southington, Conn., U.S.A.
A complete line of machines and tools for Sheet Metal Fabrication . . . Since 1785

NEW SHOP EQUIPMENT

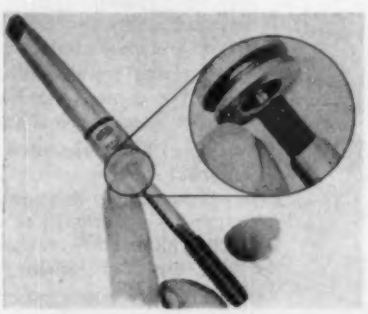
Portable Abrasive Belt Machine Does Light Grinding, Finishing

The Pee-Wee deburrs, removes seams, and polishes small parts. Designed to grind both inside and outside surfaces, it does either operation by a rearrangement of the pulleys and coated abrasives belt.

The unit uses an abrasive belt 1 x 42 in. for polishing inside contours, 1 x 48 in. for conventional work. Operating speed of the belt is 2100 sfpm. Machine uses a 6 x 6-in. cast iron table to support the workpiece. The grinder measures 8 x 16 x 22 in. With oak base and a ¼-hp 1750-rpm motor it weighs 31 lb.

Rofran Co, Robsen Products Div, 107 Chandler Ave, Linden, NJ

MORE DATA? Circle 145, inside back cover

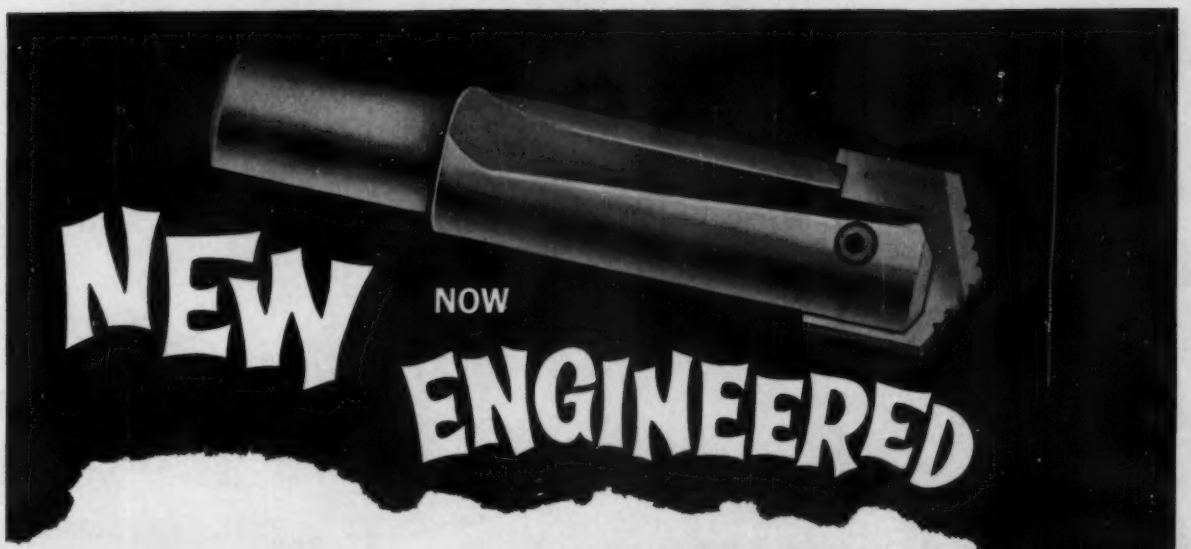


Bilz MT Tap Chuck Has Partial Float

The Otto Bilz Morse Taper tap chuck is said to eliminate all of the objectional features of the old style split tap chucks. For fast change of taps, user pushes the bushing, removes the tap by hand. Once installed, Bilz MT chucks need never be removed to change taps. Partial float compensates for most misalignment.

T M Smith Tool Co, 14644 Puritan Ave, Detroit 27, Mich

MORE DATA? Circle 146, inside back cover



NEW NOW ENGINEERED

ERICKSON INSERTED BLADE

EQUALS DRILLING ACTION OF TWIST DRILL

SPADE DRILLS

MORE RANGE AT MUCH LOWER COST THAN TWIST DRILLS

FULLY ENGINEERED BLADE GRIND...

Increased cross section at the cutting edge provides Greater Thermal Efficiency—Longer Tool Life than competitive blades.

FREER CUTTING ACTION

Exclusive Erickson method of grinding cutting angles gives Freer Cutting Action since end pressures are reduced.

"Heeling" eliminated.

EASY-TO-USE GRINDING FIXTURE...

Restores Original Factory Grind eliminating biggest obstacle to use of Spade Drills.

All cutting angles maintained during successive regrinds to original factory grind.

SPADE DRILL HOLDERS CORRECTLY ENGINEERED

"Funnel Effect" provided in flute design to speed chip escape.

Scientific distribution of coolant over whole cutting edge.

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Send Your Drilling Problems to

ERICKSON TOOL COMPANY

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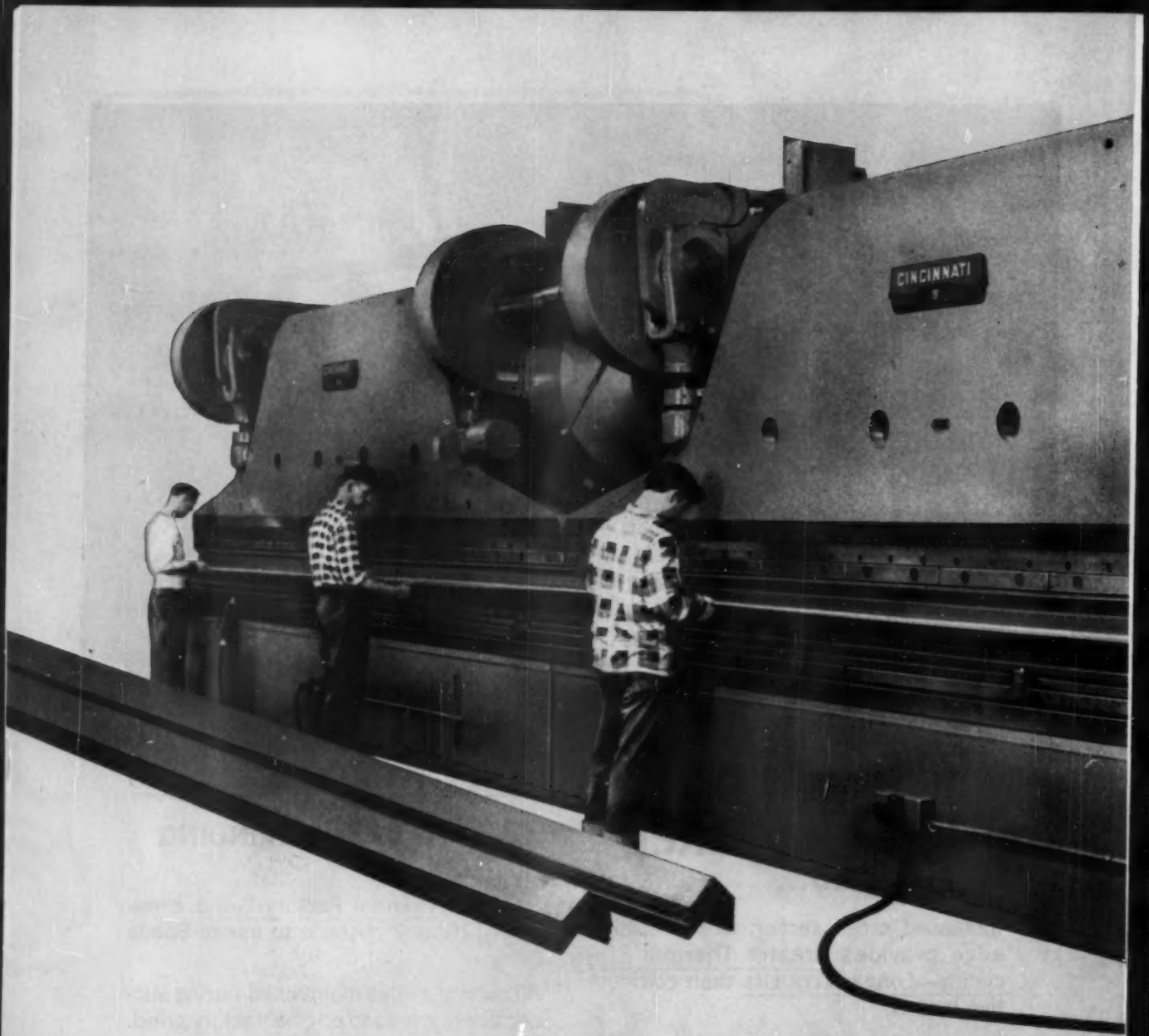
COLLET CHUCKS • EXPANDING MANDRELS • AIR-OPERATED CHUCKS • FLOATING HOLDERS • TAP CHUCKS
• AUTOMATIC INDEXING • MASTER SPACERS • DIAPHRAGM CHUCKS • PUSH-ON ARBORS • QUICK-CHANGE HOLDERS
• EXPANDING COLLETS • END-CLAMPING CHUCKS • AIR CYLINDERS (allowing stock to pass through)
• EXPANDING JAW MANDRELS • SPECIAL HOLDING FIXTURES (including gear-holding)
• BORING BARS • SPADE DRILLS • RECESSING TOOLS

CIRCLE 380 READER SERVICE CARD ▲

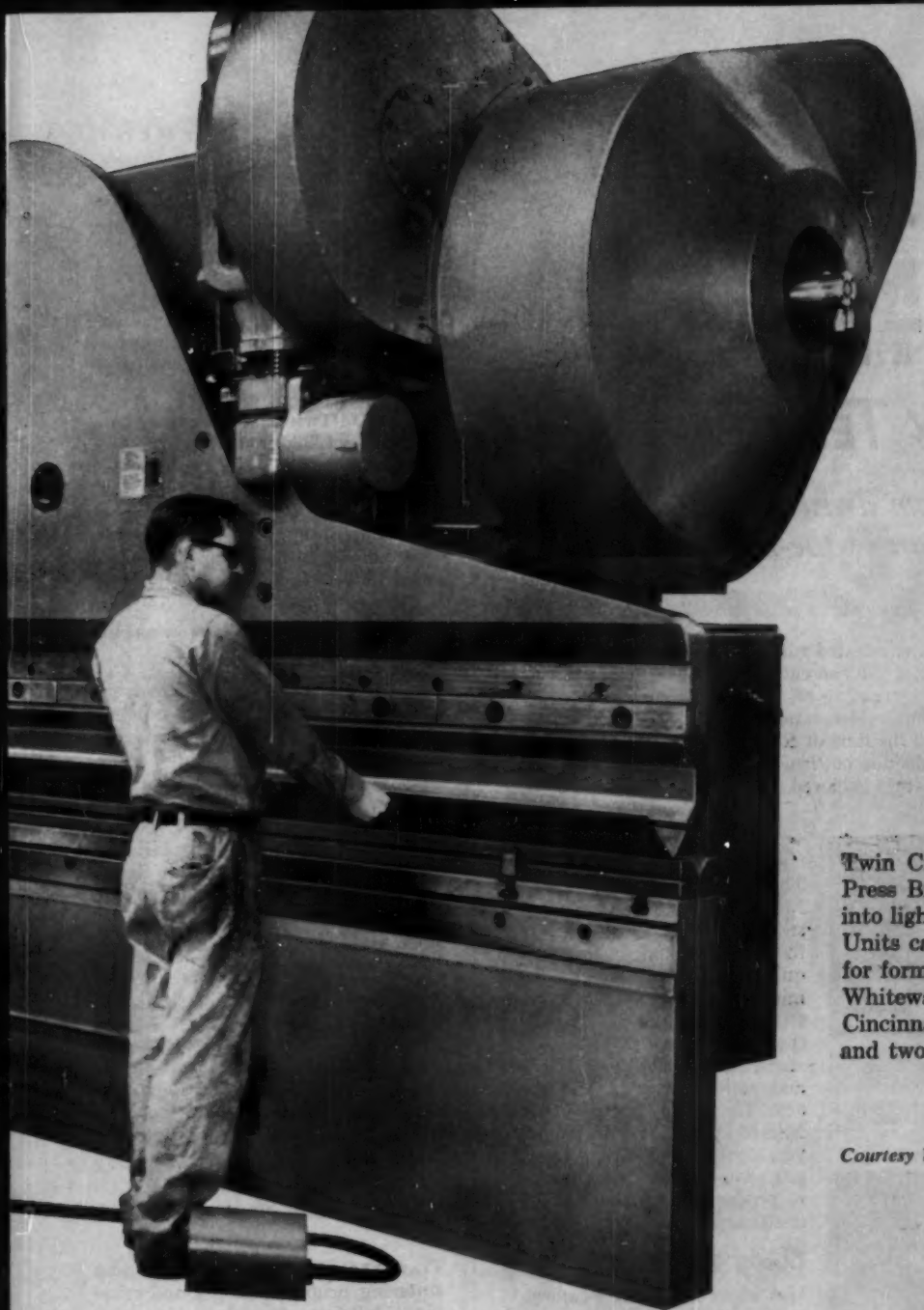
CIRCLE 381 READER SERVICE CARD ►



CINCINNATI® AUTOMATIC CYCLE PRESS BRAKE

improves

These twin Cincinnati Automatic Cycle Press Brakes have increased production "by 33% or more" and opened up lucrative new markets for the Whiteway Manufacturing Co., makers of outdoor lighting equipment.



Twin Cincinnati Automatic Cycle Press Brakes bend ¼-inch steel into light poles up to 40′ long. Units can be operated individually for forming poles up to 20′ long. Whiteway also has two more Cincinnati Press Brakes and two Cincinnati Shears.

Courtesy Whiteway Manufacturing Co., Cincinnati

production 33%

According to Whiteway President Joseph H. Spaulding, "Even an experienced operator, skilled at jogging the ram down on a conventional machine, can't match the speed of these Automatic Cycle Press Brakes. "I wouldn't consider buying another press brake without Automatic Cycle."

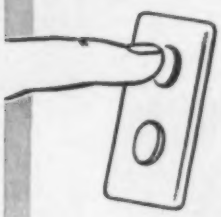
Buying these machines enables Whiteway to enter new markets in outdoor lighting which require poles up to 40 feet long.

THE **CINCINNATI SHAPER** CO.

Shapers / Shears / Press Brakes Cincinnati 11, Ohio, U. S. A.

In Scotland: The Cincinnati Shaper Co., Ltd., Glasgow

You're all SET TO GO with

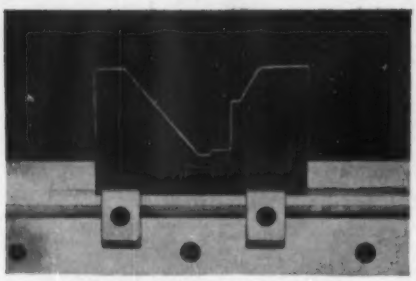


MIMIK® TRACER

and **TEMPLATOR®**

Work direct from drawings with short runs and run-of-the-mill parts.

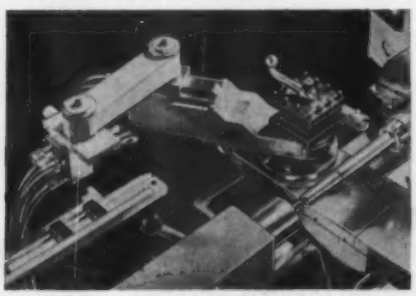
Set up time is virtually eliminated with the Mimik Templator and Mimik Tracer. Now you can cut a precision template in double quick time just by reading off your profile measurements and angles on to the simple Templator controls. With the Mimik Tracer taking one-third the time of conventional methods, it is easy to see how production bottlenecks can be eliminated and substantial cost savings achieved.



.003" template sandwiched between sheet plastic and precision cut by Mimik's exclusive Templator method, clamped ready for tracing.

New and Faster

The Templator, exclusive to Mimik, reduces tracing time still further by enabling you to produce a template on any quill type vertical mill in 45 minutes. Now you can go straight from the drawing to the finished part in two easy steps, faster than ever before and with unparalleled accuracy. The Templator and the Mimik Hydraulic Tracer give you a perfect production team geared to meet sudden switches in production and impossible deadlines.



Mimik Tracer head and single point tool does all the work. Super-sensitive stylus traces from template or master to below ± .001.

Only **MIMIK®**

Has These Exclusive Features

Reverse contouring and automatic lubrication are important features developed exclusively for Mimik Tracers. In addition, when you buy a Mimik Tracer you can have a definite guarantee of time and performance related to a specific job and machine.

Write for Mimik Tracer and Templator folders and name of your nearest distributor today.

MIMIK TRACERS INC. BUFFALO, N.Y.

EAST: Mimik Tracers Inc., 3901 Union Rd., Buffalo, N.Y. CENTRAL: Bartsch Tool Corp., 3714 Oakton St., Skokie, Ill. WEST COAST: Allied Pacific Manufacturing Co., Compton, Cal. CANADA: Retor Developments Ltd., Galt, Ont.

MIMIK® TRACERS

A velvet touch and a tiger's response

◄ CIRCLE 382 READER SERVICE CARD ▲ CIRCLE 383 READER SERVICE CARD

NEW SHOP EQUIPMENT

Instrument lathe, with collet capacity of ½ in., is intended for use with parts that are fairly large but require delicate operations. Driven by a ¼-hp motor, lathe has spindle speeds from 0 to 4000 rpm—*Louis Levin & Son, Inc, 3610 S Broadway, Los Angeles 7, Calif*

MORE DATA? Circle 147, inside back cover

No. 102 Arc-Twin Tandem makes two complete notched ends (four notchings) of either pipe or tubing with one stroke of punch press. One unit can make a variety of slottings such as T, flared, or long narrow slots with same precision and speed—*Vogel Tool & Die Corp, 1825 N 32nd St, Stone Park, Ill*

MORE DATA? Circle 148, inside back cover

Uni-Grip auxiliary vise jaws convert machine vises instantly into universal vises to grip and clamp round, angular, and irregular shapes. The faces of Uni-Grips are a series of case-hardened steel wedges, with freedom of movement like steel fingers, that automatically conform to irregular shapes when vise is closed —*Mid-American Import Co, Inc, 939 Grant St, Denver 3, Col*

MORE DATA? Circle 149, inside back cover

Automatic drum welder produces containers ranging from standard 100-lb drum to 55-gal barrels. Machine is a basic mash seam welder equipped with a number of auxiliary parts including an automatic roll former — *National Electric Welding Machines Co, 1846 Trumbull, Bay City, Mich*

MORE DATA? Circle 150, inside back cover

Tray-type atmosphere furnace does sintering, bright annealing, and brazing. Units are furnished for direct gas connection without blower, compressed air, or other piping, for any type gas. Standard furnaces include silicon carbide muffles for temperatures in excess of 2000 F—*Charles A Hones, Inc, Baldwin, Long Island, NY*

MORE DATA? Circle 151, inside back cover

Portable hand nibbler actually cuts through ¼-in. steel plate. Its cutting capacity includes hot or cold rolled steel and up to 5/16-in. aluminum Model EHN has cutting speed of 35 ipm—*Fenway Machine Co, 3107 N Broad St, Philadelphia, Pa*

MORE DATA? Circle 152, inside back cover

NEW SHOP EQUIPMENT

Oscillating sheet surfacer, called Tri-Matic, uses abrasive impregnated nylon mounted on an oscillating arbor which is adjustable to oscillate from 0 to 400 times a min. Workhead drive can be equipped for single or variable speed and feed rolls are equipped with variable speed drive—*Sales Service Mfg Co, 2363 University Ave, St Paul 14, Minn*

MORE DATA? Circle 153, inside back cover

Industrial control relay, the Compact 300, is rated at 6 amp, 300 v max. Unit is fixed circuit device with provisions for 8 independent poles, and requires only 5½ sq in. of panel space; this gives up to 48 poles per linear ft — *Cutler-Hammer, 315 N 12th St, Milwaukee, Wis*

MORE DATA? Circle 154, inside back cover

Patented fastener gives threaded bolts a quick disconnect feature. Bolts, for tension applications, are engaged or disengaged by releasing or depressing a button that operates a spring-loaded mandrel. They are available in alloy or stainless, in 5/16, ⅜, and ½-in. sizes—*Avdel, Inc, 210 S Victory Blvd, Burbank, Calif*

MORE DATA? Circle 155, inside back cover

Tungsten carbide rotary files, tradenamed Bi-Dex, have new design said to combine the best advantages of both sectional and center fluting. It eliminates chatter and chip-clogging at nose of file and does away with cumbersome "dead area" encountered with radius ends—*Grobet File Co of America, Carlstadt, NJ*

MORE DATA? Circle 156, inside back cover

"I'm sorry, Buxton, but feeling 65 isn't enough. You have to be 65."

CUT ACCUMULATED ERRORS to a minimum

with the

DIXI 75 horizontal optical jig borer

increased
ACCURACY
VERSATILITY
PRODUCTIVITY

Made in Switzerland
Measurement in inches

- Automatic positioning can be changed instantly to manual operation
- Projected optical setting—direct reading to .00005" for linear motions and 1 sec. of arc for built-in rotary table. Linear optics provided with adjustable zero reference
- Simplified controls functionally arranged for greater operating speed and efficiency
- 3" diameter boring spindle
- Increased capacity: table size 39⅜" x 32"; 29⅝" cross travel; 23⅝" longitudinal travel; 25⅝" vertical travel
- Hydraulic feeds and infinitely variable spindle speeds
- Rear support optional

MBI has engineers available for consultation, guarantees service by factory trained staff, and stocks spare parts in New York.—Join the long list of leading aircraft and manufacturing plants throughout the United States which are using the horizontal optical jig borer.

Demonstrations upon request at our conveniently located demonstration centers.

MBI

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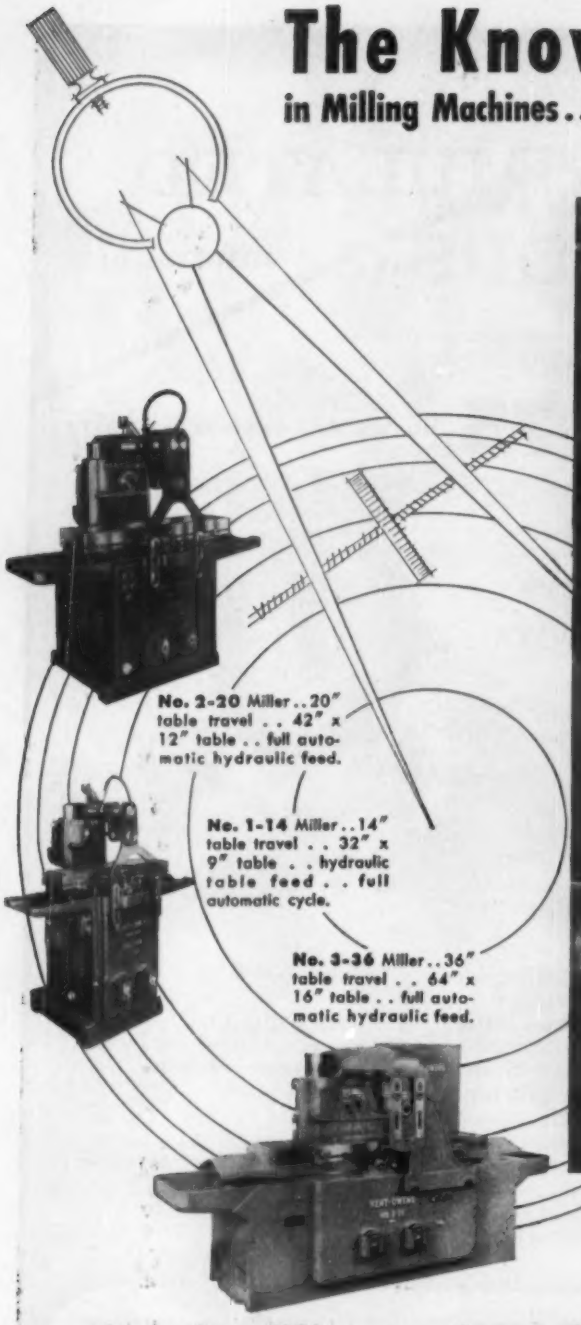
A DIVISION OF MACHINERY BUILDERS, INC.
475 Grand Concourse, Bronx 51, N. Y.
Swiss Accuracy plus U. S. Know-how

The Know-How Dimension

in Milling Machines . . Special Machinery . . Automation Equipment



No. 2-20 Miller . . 20" table travel . . 42" x 12" table . . full automatic hydraulic feed.

No. 1-14 Miller . . 14" table travel . . 32" x 9" table . . hydraulic table feed . . full automatic cycle.

No. 3-36 Miller . . 36" table travel . . 64" x 16" table . . full automatic hydraulic feed.

A section of our assembly floor showing Automation-Type Machines in process of manufacture.

. . makes the difference in cutting costs . . increasing production

Know-How, born of years of experience, abetted by sound and imaginative design and quality manufacturing standards . . . is the reason why many of our customers, representing a wide and diversified coverage of industry, come back to us again and again for *answers* to their production problems.

When you are considering procurement of machinery for your milling needs . . . or seeking the solution to other production problems . . . you may wish to consider a Kent-Owens Milling Machine or a Special Machine designed for a distinctive and individual application. Contract Machine Building (customer designed equipment) is another of our specialties.

Write or call . . . Kent-Owens will be pleased to quote your requirements. Kent-Owens Machine Company, Toledo 10, Ohio.

KENT-OWENS *Designers and Builders of Milling Machines and Special Machinery*

NEW SHOP EQUIPMENT

Rotary selector switch has 1 to 20 load circuits, each of which is easily adjusted through 1 to 12 on-off positions. Each circuit has 10 amp ratings. Circuit adjustment is done quickly by inserting removable cam segments in 1 to 12 locations—*Industrial Timer Corp, McCarter Hwy, Newark 4, NJ*

MORE DATA? Circle 157, inside back cover

Transmissions with electro-magnetic clutches provide speed changes and reversing under power without interrupting power source. They are available with two to eight speeds, capacities from 52 to 750 ft lb, and a wide ratio selection (up to 10:1)—*Western Mfg Co, 3400 Scotten Ave, Detroit 10, Mich*

MORE DATA? Circle 158, inside back cover

Feeding equipment, for handling of delicate, fragile, and highly finished parts, receives a load of parts in a random position and delivers them, properly oriented, to a transfer track without damage, marking, or scratching—*Aidlin Automation, Inc, 1613 E New York Ave, Brooklyn 1, NY*

MORE DATA? Circle 159, inside back cover

Aluminous oxide resin bonded abrasive disc, designed for metal cutting, is available in 7 and 9⅛-in. diameters in a choice of five standard grains. One 100-unit package of No. 60 grain RD discs sells for under $30—*Chicago Wheel & Mfg Co, 1101 W Monroe St, Chicago 7, Ill*

MORE DATA? Circle 160, inside back cover

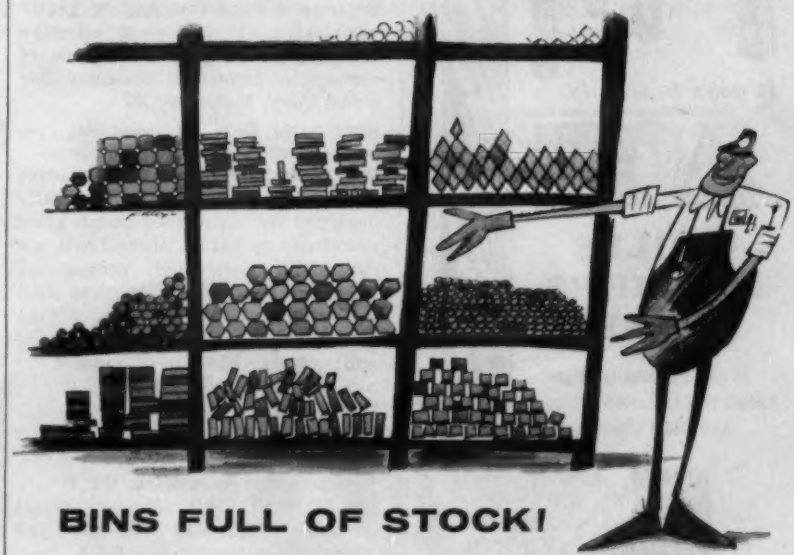
Target and center-cut gun drills have twisted or helical fluted shanks that provide smoother operation and better balance at high spindle speeds. The new drills greatly reduce undesirable whipping and vibration which is encountered when medium and small-diameter, conventional gun drills are run at high speeds—*National Twist Drill & Tool Co, Rochester, Mich*

MORE DATA? Circle 161, inside back cover

Magnetic motor starters, sizes 2 and 2½, have unitized construction with all components front removable. Features include plug-in type push buttons or selector switches. Thermal overload relays with trip indicator are trip-free and tamper proof—*Furnas Electric Co, 1000 McKee St, Batavia, Ill*

MORE DATA? Circle 162, inside back cover

BEANS FULL OF KNOWLEDGE...



BINS FULL OF STOCK!

If you use alloy steels in your operations, you will find Wheelock, Lovejoy a most useful ally. W-L offers you complete servicing of your alloy steel needs. There are seven strategically-located W-L warehouses, each of which is fully staffed by veteran metallurgists, ready to give you expert advice as to grades, applications, heat treating, etc.

Each W-L warehouse maintains complete stocks of alloy steels, including standard AISI and SAE steels, and our own HY-TEN steels, which offer advanced metallurgical features at competitive prices.

With Wheelock, Lovejoy, you merely order the steel you need—as you need it—in specified sizes, shapes, grades and treatments.

For service that's complete, and completely satisfactory, call the W-L branch nearest you.

W-L STEEL SERVICE CENTERS – Cambridge • Cleveland Chicago • Hillside, N. J. • Detroit • Buffalo • Cincinnati

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WHEELOCK, LOVEJOY & COMPANY, INC.

136 Sidney St., Cambridge 39, Mass.

STEEL SERVICE CENTER INSTITUTE

Highly polished flutes produce smoother, more accurate holes!

It pays to specify

ACE

DRILLS
REAMERS
BLANKS

Premium Quality High Speed Steel, Carbide Tipped and Solid Carbide.

DRILL SETS

Fractional, Wire and Letter size drill sets packed in convenient folding index cases.

BLANK SETS

Uniformly hardened high speed steel reamer and drill blanks precision ground to new close tolerance limits.

Call your local distributor today—or write Ace direct for latest catalog and price information.

ACE DRILL
Adrian, Michigan

ORIGINATORS OF "GROUND-FROM-THE-SOLID" DRILLS

NEW SHOP EQUIPMENT

Series of hydramic notching presses, in capacities of 10, 20, and 30 tons, are available to handle maximum notching dimension from 2 x 1 in. to 2½ x 2 in. in metal thicknesses up to ⅜ in. A ½ hp hydraulic power unit is standard—*W A Whitney Mfg Co, 636 Race St, Rockford, Ill*

MORE DATA? Circle 163, inside back cover

Drum Jet washer cleans tote boxes of screw machine products and other small parts in volume. The washer features a development which permits parts to be cleaned and dried while remaining in their respective tote boxes throughout all stages of processng. Furthermore, the rotational action of the washer gently tumbles work for most effective cleaning of parts without risk of damage — *Industrial Washing Machine Corp, Matawan, NJ*

MORE DATA? Circle 164, inside back cover

Roll feeds have been added to press accessory equipment line. Specifically designed for high speed punch press automatic operation, these feeds are ruggedly constructed throughout. They are available in 14 sizes with maximum feed lengths ranging from 2½ to 12 in. and a variety of stock widths from 4 to 12 in.—*Cooper Weymouth, Inc, 600 Honeyspot Rd, Stratford, Conn*

MORE DATA? Circle 165, inside back cover

Rocker action footswitch, the Treadlite Model T-51-D, allows a visual check to see if circuit is on or off, and gives instantaneous control with a minimum of foot movement and light pressure. Rated at 7 amp, 125-250 V ac, the T-51-D is housed in a 3½ x 2⅝ x 1-in. smooth-finish black steel casing, with a ribbed rubber tread on treadle—*Linemaster Switch Corp, 432 Woodstock Terrace, Woodstock, Conn*

MORE DATA? Circle 166, inside back cover

Four improved drill press and milling machine vises, said to eliminate the need for special and expensive jigs and fixtures, feature interchangeability of parts from one vise to another of the same size. All working parts are replaceable—*Columbia Vise & Mfg Co, Cleveland 4, Ohio*

MORE DATA? Circle 167, inside back cover

Portable dial micrometer thickness gage, which has a maximum working range of 0.500 in., has a large, easy-to-read 2-in. dial calibrated to 0.00025 in. One revolution of main pointer equals 0.050 in., while small revolution counter records up to the ½-in. capacity—*Quadra-Continental, 2022 Westlake, Seattle 1, Wash*

MORE DATA? Circle 168, inside back cover

Dex-A-Mill face and shell end milling cutters were especially developed to extend carbide insert life, remove more metal per cutting edge, and produce exceptionally fine finishes. Greater accuracy has been built in with a two-piece body construction that enables insert seats to be uniformly ground to extremely close tolerances — *Adamas Carbide Corp, Kenilworth, NJ*

MORE DATA? Circle 169, inside back cover

Custom built chuck jaws to fit any chuck, lathe, turet lathe, miller, chucking machine, or multiple spindle machine provide for greater machining accuracy, better holding power of a specific workpiece, and increased production. One week deliveries are given on the Grip-Lock line of chuck jaws—*Royal Machine & Tool Corp, 31 Deming Rd, Berlin, Conn*

MORE DATA? Circle 170, inside back cover

Muretran all-purpose inert arc welding machines can be used for manual, automatic, inert-gas spot, or Sigma welding simply by changing a switch. A special flux density control permits remote control of both the ac and dc welding currents—*Metal & Thermit Corp, General Offices, Rahway, NJ* •

MORE DATA? Circle 171, inside back cover

"When you said, 'Pass me the screw driver', did you mean the six-sided Phillips, reverse Allen, straight split blade, obtuse Bristol, round clutch head, Kirby head or flat head?"

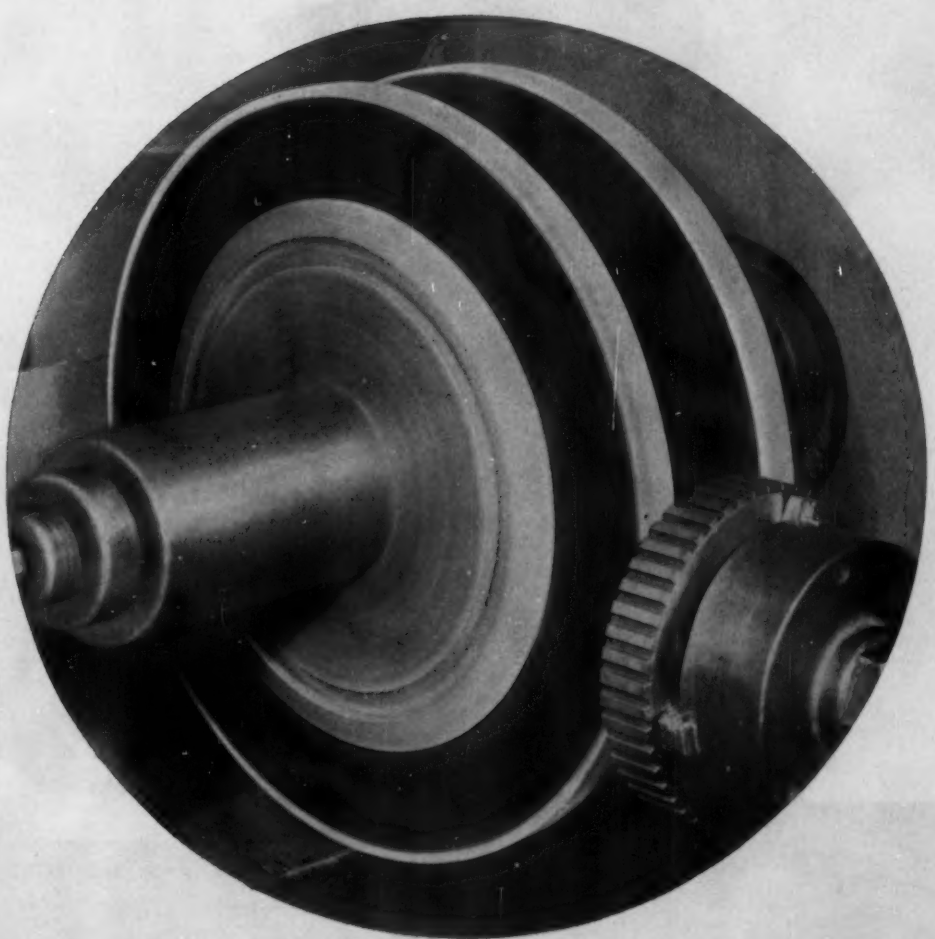
BREAKTHROUGH IN METAL FINISHING! NEW OSBORN MASTER BLEND* BRUSHES . . . a totally new kind of power brush . . . in construction . . . in the unusually wide range of metal finishing jobs it can accomplish . . . in extra service life. You have never used a power brush like this before! • MASTER BLEND features fast-action straight wire cutting points blended with a tough plastic bond. Result: an exceptional precision power brushing tool that goes far beyond any brush you've ever used • Keeps its sharp profile for precision control over the working area throughout its long service life. Won't flare out • Scores big advantages over other accepted finishing methods. Can't rip or tear. Won't load up • Has extraordinary cutting power. Edge-blends and deburrs perfectly. Peening is kept to an absolute minimum, and—in many cases—is entirely eliminated. No compound required • Finishes more parts per hour, more parts per brush. Two years of research and on-the-job tests proved it. MASTER BLEND will outperform . . . outlast . . . any other power brush available. **FREE BULLETIN MB-100** includes MASTER BLEND Brush sizes, types, applications. Write or call *The Osborn Manufacturing Company, Dept. C-106, Cleveland 14, Ohio. Phone ENdicott 1-1900.*

* Trademark

breakthrough

Metal Finishing Machines . . . and Finishing Methods
Industrial Brushes • Foundry Production Machinery

OSBORN



CIRCLE 388 READER SERVICE CARD ▲

CIRCLE 389 READER SERVICE CARD ►

At Amana Refrigeration, Inc.

STANOIL

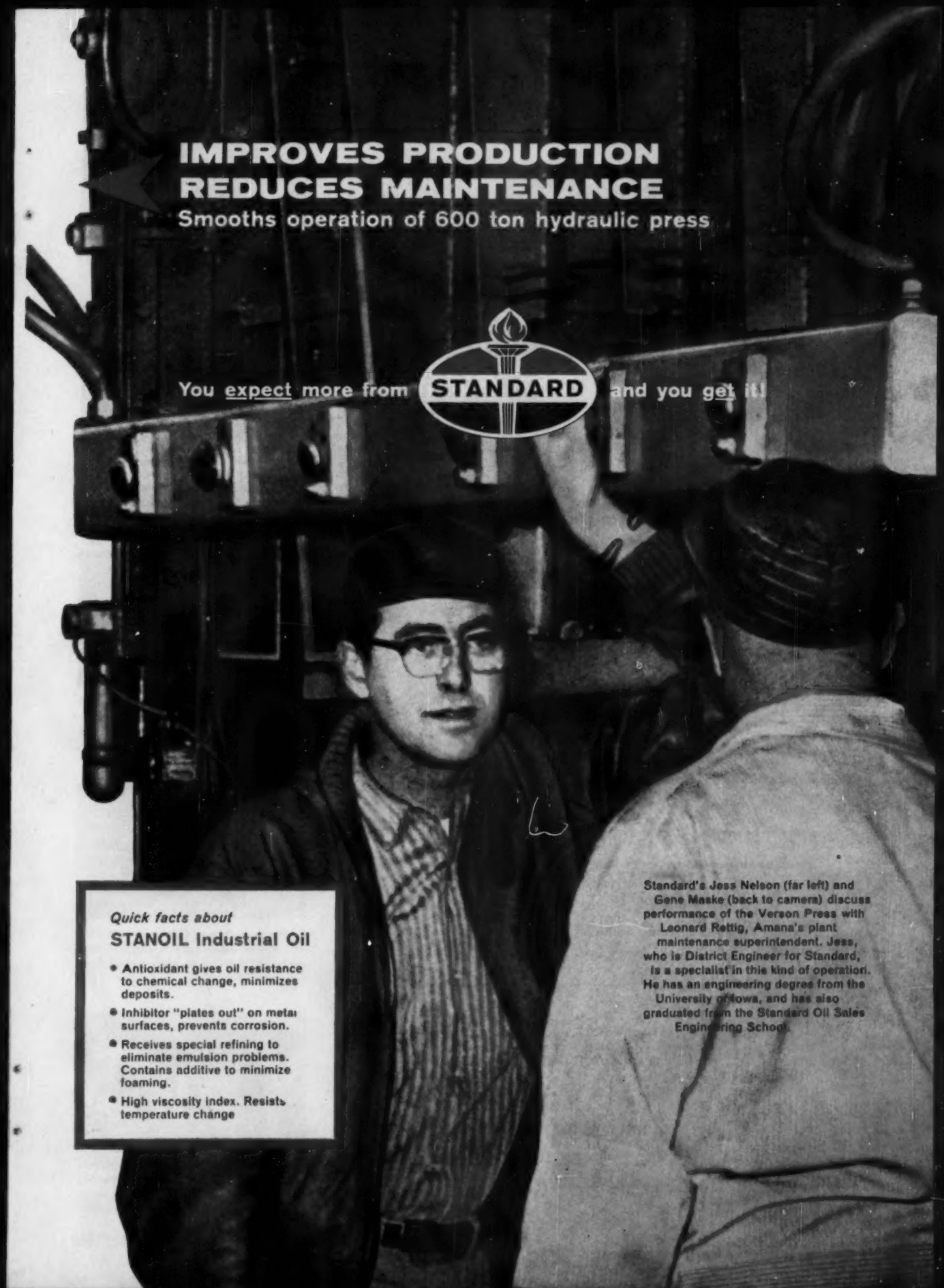
Situation: The 600 ton Verson Press at Amana is a vital operating component in the manufacture of home freezers and refrigerators. Its proper performance is necessary to the efficiency of Amana's entire manufacturing operation. That's why erratic press operation, caused by foaming of the hydraulic oil, was a serious problem.

What was done? In seeking the solution to this problem, Amana consulted their Standard Oil lubrication specialist who recommended STANOIL for this service. STANOIL Industrial Oil is a top quality, first-line industrial lubricating and hydraulic oil. It will provide excellent service in many different applications. And when tested by Amana, STANOIL proved perfect for use.

What has happened? Since STANOIL was first put to work at Amana, it has performed for extended periods of time without foaming or oxidation, lengthening the time between drainings and improving press operation. As a result of this record, STANOIL has been adopted for use on other production equipment, together with Standard's RYKON Greases and SUPERLA Soluble Oil.

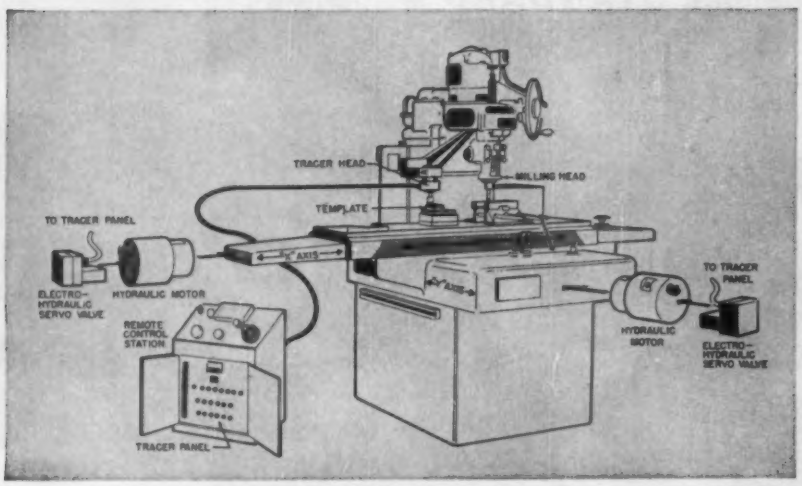
What you can do: To get help in solving your lubrication problems and to learn more about STANOIL Industrial Oils, simply call the Standard Oil office near you in any of the 15 Midwest or Rocky Mountain states. Or write **Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.**

Production manager Neal Stewart reviews Amana's maintenance expense reductions with Standard's Jess Nelson.


IMPROVES PRODUCTION
REDUCES MAINTENANCE
Smooths operation of 600 ton hydraulic press
You expect more from STANDARD and you get it!
Quick facts about
STANOIL Industrial Oil
• Antioxidant gives oil resistance to chemical change, minimizes deposits.
• Inhibitor "plates out" on metal surfaces, prevents corrosion.
• Receives special refining to eliminate emulsion problems. Contains additive to minimize foaming.
• High viscosity index. Resists temperature change
Standard's Jess Nelson (far left) and Gene Maske (back to camera) discuss performance of the Verson Press with Leonard Rettig, Amana's plant maintenance superintendent. Jess, who is District Engineer for Standard, is a specialist in this kind of operation. He has an engineering degree from the University of Iowa, and has also graduated from the Standard Oil Sales Engineering School.

for modern, efficient
machine control . . .

Honeywell's new Electro-Hydraulic Servo Systems and Components



360° electro hydraulic tracer control system

Tracer control systems—fast, accurate and reliable system response for smooth application of large increments of hydraulic power. The flexibility, remote control and intelligence of electronics are coupled with the power and "tight" actuation of hydraulics.

Speed control systems—speed ranges of 1000 to 1, speed regulation to 0.1%, and consistent speeds to 1 rpm are possible with electro-hydraulic speed control.

Position control systems—positioning of cylinders or motors to the most exacting specifications.

Speed and position—synchronization and programming—control of tension, force, level, torque, etc.

For further information on Honeywell's new machine control systems and components, and their application to your specific job, call your nearest Honeywell office. Or write: Minneapolis-Honeywell, Department AM-12-12, Minneapolis 8, Minnesota.

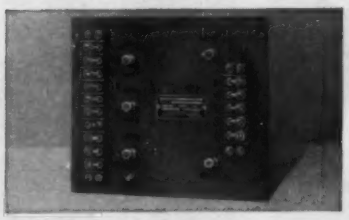
Honeywell

First in Control

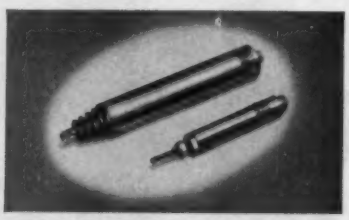
SINCE 1885

75th YEAR — MEASURING THE FUTURE

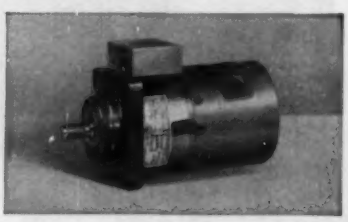
Electro-hydraulic servo valves—2-, 3- and 4-way valves with output flow proportional to input signal. Designed specifically for industrial use.



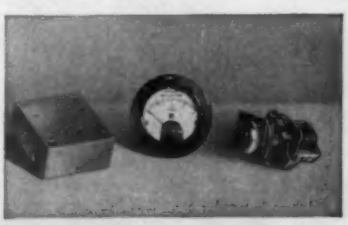
Transistorized servo amplifiers—proportional and integrating low voltage amplifiers designed for servo systems, incorporating servo valves, d-c relay and servo motors.



Feedback transducers—industrialized linear and rotary transducers providing accurate sensing and feedback for servo loops.



Hydraulic motors—roll-vane motors producing high torques at low speeds. Often connected directly to load. Integral tachometer optional.



Servo accessories—input commands, meters, manifolds, phase conversion panels, consoles, etc., to complement the servo control systems.

Valeron Corp Forms Press Brake Division

New manufacturing unit that'll specialize in the design and manufacture of press brake tooling exclusively has been established by Valeron, Detroit manufacturer of metal cutting tools. The unit will be located in Addison, Ill, where a new plant designed and built expressly for the manufacture of press brake dies has been recently completed.

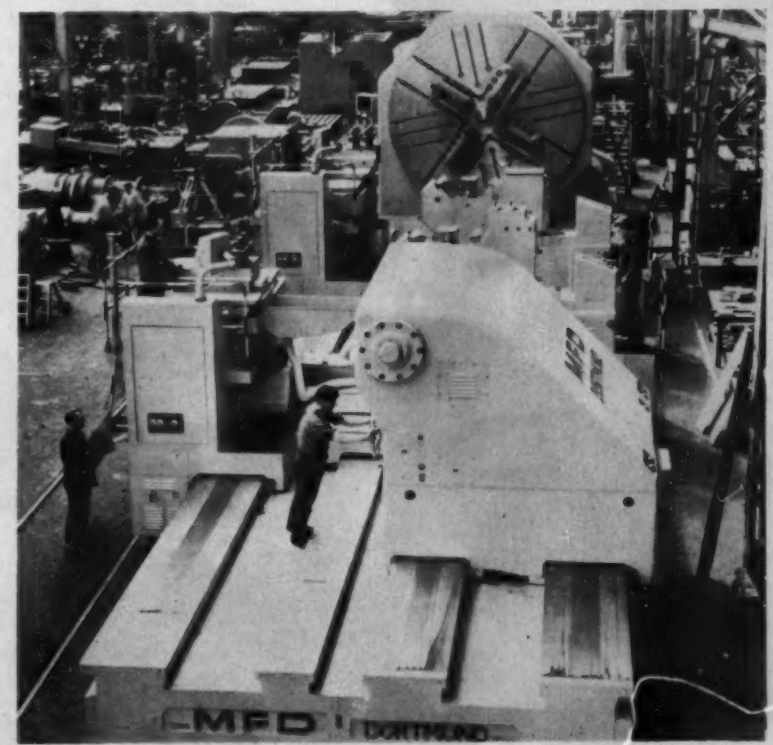
Providing over 17,000 sq ft of manufacturing area, the new facility is one of the largest plants in the US devoted solely to press brake tooling. Equipment includes a vertical spindle surface grinder that provides 240 linear inches of reciprocating table travel, said by its manufacturer, Thompson Grinder Co, to be the largest of its type ever produced by the company. In addition, there are batteries of shapers and shaper-planers capable of machining several dies at once in extra long sections.

Russia to Fill $30 Million Aircraft Order for India

Order placed by the Indian government with the Soviet aircraft industry covers $30 million worth of aircraft and helicopters. Payment is to be made in non-convertible rupees with delivery expected sometime next year. Indian delegation now in Moscow to discuss details has negotiated the first purchases to cover 18 aircraft—ten helicopters and eight transport planes. The delegation is also reported to have placed a substantial order for heavy road-building equipment.

Ford Orders Big Equipment For Alabama Plant

Three 1200-ton die casting machines with 25-ton dies for each, and a holding furnace of 3500-lb capacity will be installed at Ford's Sheffield, Ala, plant in a major extension of its automotive parts production. The facility, which opened in the summer of 1958, turns out more than 60 different engine and automatic transmission parts for Ford models. The new equipment will be used to die cast transmission cases for Fords and Falcons when the 1962 model production is started; they're now manufactured by the permanent mold process.



MFD giant lathes are part of equipment at AG Brown, Boveri's newest and largest electric installation at Birr, Switzerland. They machine components for generators, transformers, and other electric equipment with kva ratings of up to 500,000. The lathes are accurate to 0.0004 in.; height from bed to top of faceplate is 86 in.; diameter is 12 ft 5 in. and maximum distance between centers is 42 ft 5 in. Turning speeds of from 0.4 to 64.8 rpm can be attained and allowable workpiece weight may reach a maximum of 330,000 lb

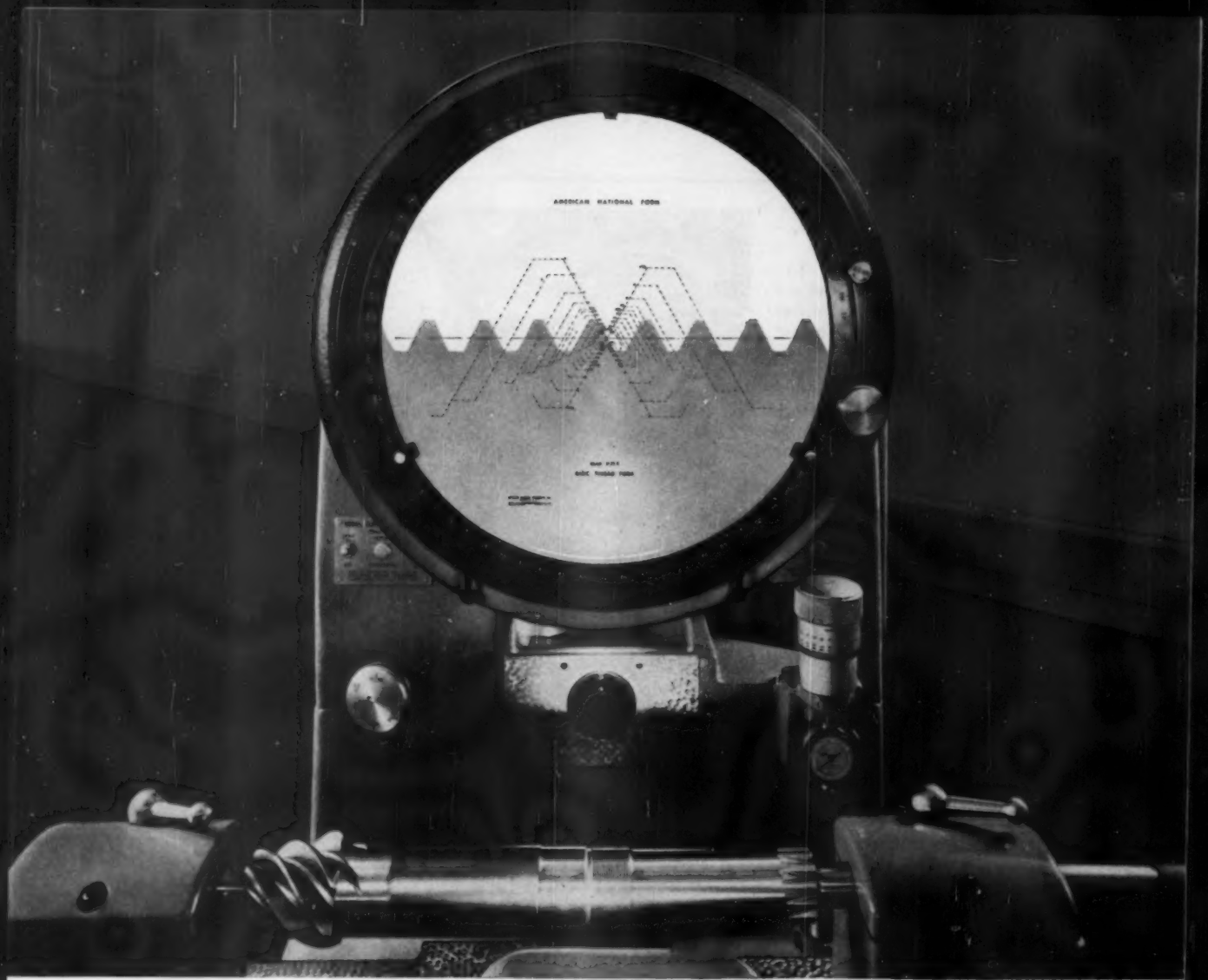
Advanced Nickel Plating Process Developed by Udylite

Process, called N2E, for electroplating a coating of sulfur-free, semi-bright nickel on metal surfaces is expected to reduce costs and improve the appearance and durability of electroplated finishes on automotive parts, appliances, and other metal products. Process involves the simultaneous addition to the electroplating bath of two Udylite addition agents,

McGIRK'S WORKS

by GEO CRENSHAW

HEY, MONK!... WHERE ARE YOU GOING WITH THAT AUTOMATION MACHINE? I JUST PUT IT IN PERFECT WORKING CONDITION!
AUTOMATION MACHINE
DUMP REFUSE HERE
ELEC-TRONICS DEPT.
KEE-RASH!
SPROINNG
SSSSS!
IT TALKED BACK TO THE BOSS!
MOE'S CORNER
The Boss
I didn't get the raise but he put me closer to the exit so I can get home earlier.



BETTER GEARS by making mountains out of molehills

This optical comparator is doing just that. The threads on the pinion in the foreground are magnified 31.25 times on the calibrated screen for intensely accurate inspection.

This is one of many details of gear manufacture and inspection that have won Double Diamond gears their reputation as gears thoroughly qualified for high level performance in any application for which you buy them.

Our sales representatives are engineers and gear designers—ready to tackle a gear assignment at any stage of its development. When may one call on you? Just write or phone.

EATON

AUTOMOTIVE GEAR DIVISION
MANUFACTURING COMPANY
RICHMOND, INDIANA

GEARS FOR AUTOMOTIVE, FARM EQUIPMENT AND GENERAL INDUSTRIAL APPLICATIONS
GEAR-MAKERS TO LEADING MANUFACTURERS

CIRCLE 392 READER SERVICE CARD

Brightener E and Brightener 2N.

One of the basic advantages over the semi-bright nickel processes is the lack of harmful breakdown products. Batch treatments are almost never required, according to Executive Vice President L V Nagle. It can be applied in any plating sequence in which other semi-bright nickel processes are now used. It readily permits the use of higher bath temperatures up to 150° for high-speed plating.

Bliss Relocates Press Sales

E W Bliss has moved its press sales headquarters from the general office in Canton, Ohio, to the company's plant at Hastings, Mich, as a part of its program of decentralization. Most of the presses produced by Bliss are built at Hastings and relocation will simplify handling of sales and service contacts. Facilities at Hastings are adequate to handle all but the largest machines which will be built at the Salem, Ohio plant.

Lockheed Division Plans $4 Million Expansion

Lockheed Missiles and Space Division will start construction early next month of a 172,800 sq-ft engineering and laboratory building scheduled for occupancy by June. The building will be the first on the 345-acre Holthouse property acquired by Lockheed early last year. Expansion of physical facilities will be accompanied by a rise in employment, according to a company spokesman. More than 15,000 are currently at work in the Sunnyvale plant and another 800 are scattered at leased facilities in the surrounding area.

Chicago Firm Moves to Tenn

Ryan & Hart Co is moving its midwest facility to Johnson City, Tenn, where production will begin this month. Company makes gaskets of all types for the automobile and appliance industries.

Howe Scale Bought

Canadian Fairbanks-Morse Co Ltd, Toronto, Canada, has purchased Howe Scale Co of Rutland, Vt, one of the largest scale manufacturers in the US. Howes' sales volume is approximately $10 million a year, payroll is 800. This marks Canadian F-M's entry into the world export market.

Bendix Gets Army Contract

A contract totaling $17 million has been awarded to Bendix Corp to develop the communications system for Project Advent, a satellite whose path in space will be synchronized with the earth's orbit. Half of the contract funds have been allotted to Bendix Radio Division in Towson, Md; the remainder will go to the firm's branch in Ann Arbor, Mich.

Louis Allis Buys Electronics Firm

Dynapar Corp, Skokie, Ill, producer of custom electronic equipment including preset digital controllers, has been purchased by Louis Allis, Milwaukee manufacturer of motors, generators, and adjustable speed drives. Acquisition is the first step in Allis's program of expansion and diversification and marks its entry into the field of electronic equipment. Dynapar controls will be marketed as a separate product line and also in conjunction with Allis adjustable speed drive equipment.

Bethlehem Gets Ship Order

Bethlehem Steel Co's Sparrows Point (Md) Shipyard will get a $34.1 million contract for four ships to be built for Lykes Steamship Co of New Orleans. The Maritime Administration gave the Bethlehem Yard the order on the basis of its low bid of $8.5 million per freighter. Eight others for Lykes are on order or under construction at Sparrows Point.

"The boss is beginning to notice my work. Frankly, I'm worried."

Precision Operation In A Compact Design . . . Cuts Costs

LINLEY

JIG BORERS

Designed specifically for tool, model and experimental departments.

The Linley Jig Borer is accurate to a high degree. It is fast to set up and position and has the versatility required for precision tool room and die work, yet is low in cost.

Many time-saving accessories are now available for use with the improved Linley that add to its usefulness and simplify its operation.

Check on the many advantages of this improved jig borer. Table size is 7" x 17½"; table travel, 6½" x 10".

Send for descriptive literature.

LINLEY BROTHERS CO.
664 State Street Ext.
Bridgeport 1, Conn.

CIRCLE 393 READER SERVICE CARD

Easy Operation, Precision Measurements ...with Wilson "Rockwell" Hardness Testers

No matter what your hardness testing requirements are, there's a Wilson Rockwell instrument to do the job easily and accurately. Wilson instruments on the production line and in the laboratory offer these advantages:

Accuracy—Precision-built, with exact calibration, for consistently correct results.

Easy operation—Even an unskilled operator can get perfect readings. All controls conveniently grouped.

Long life—Simple design, rugged construction make Wilson instruments as durable as a machine tool.

Easy maintenance—Interchangeable mechanisms, with spindles mounted in oil-less bearings.

Complete line—Choose from the widest variety of instruments available, including semi and fully automatic models and Wilson "Brale" diamond penetrators.

Write for details—Ask for Catalog RT-58. It gives complete information on the full line of Wilson Rockwell hardness testers and accessories.

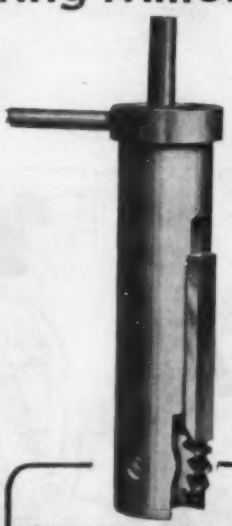
WILSON "ROCKWELL" HARDNESS TESTERS

ACCO

Wilson Mechanical Instrument Division
American Chain & Cable Company, Inc.
230-B Park Avenue, New York 17, New York

CIRCLE 394 READER SERVICE CARD

The INSIDE STORY about NATIONAL Keyseating Millers



NATIONAL Keyseating Millers are designed for milling internal keyseats . . . in one cut . . . in offset holes . . . with parallel sides . . . partly through holes . . . of standard width and depth . . . in holes that are closed at one end . . . and many other operations. A demountable guide on body of Miller enters keyseat being milled assuring straight keyseat in perfect alignment with the axis of the bore, thus making it unnecessary to clamp work to drill press table.

CUTTERS are made from high speed steel which are hardened to Rockwell specifications and accurately ground to size. Tops of teeth are staggered to break chips which reduce strain and wear on both cutter and driving pins. It will pay you to put National Keyseating Millers on the inside of your next keyseating job.

national
MACHINE TOOL CO.
CINCINNATI 22, OHIO

WRITE TODAY
for Catalog No. 17
complete, handy size

Technical Layout Service Offered by Plating Firm

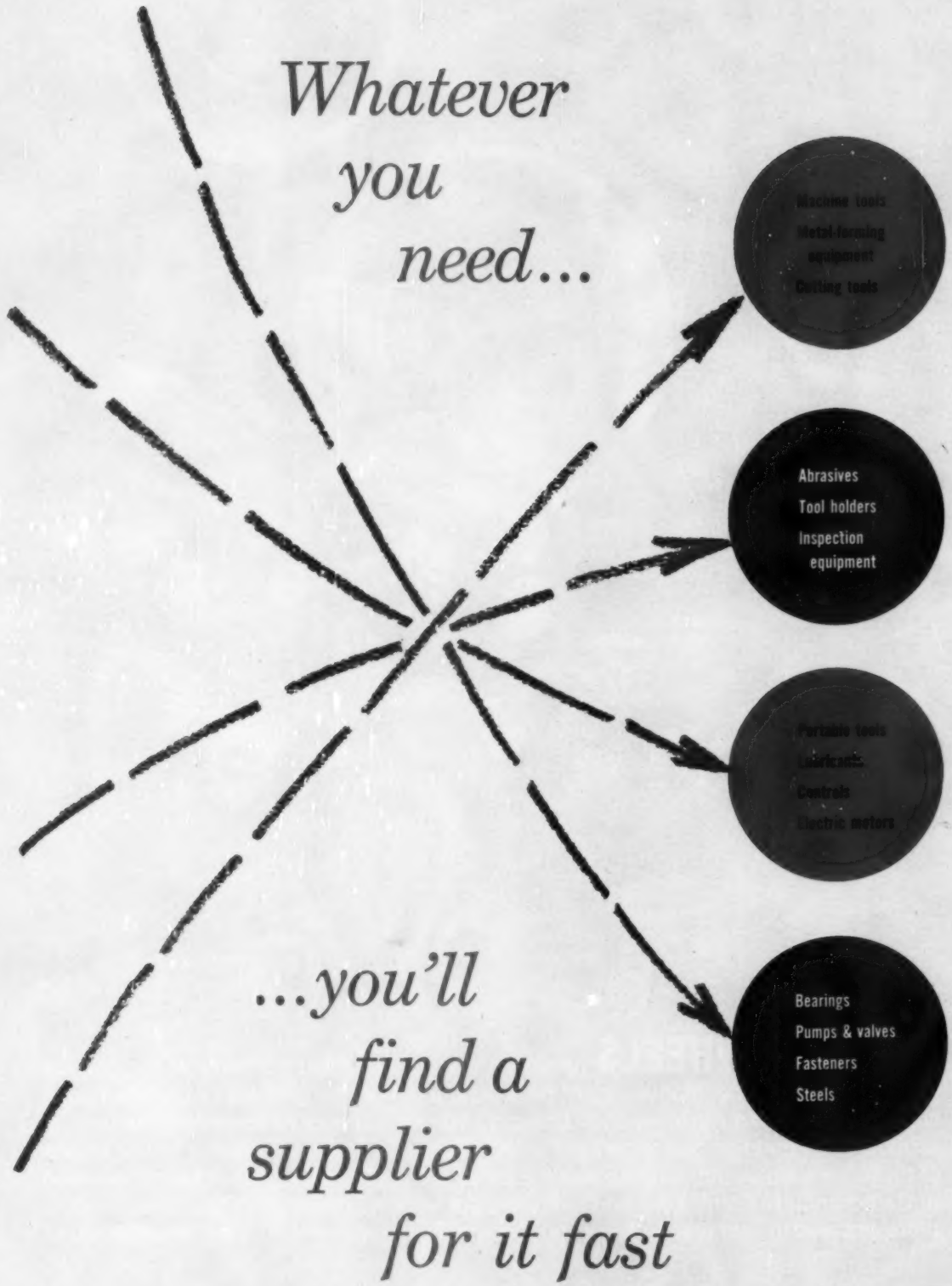
A free technical layout service is being offered by J Holland & Sons, Brooklyn polishing, plating, and spray equipment firm, to those interested in new electroplating plant installations or additions to existing facilities. Upon request, the company will undertake a complete study of a customer's electroplating and production requirements, recommend processes on a step-by-step basis, and suggest the type, quantity, and placement of the necessary equipment. Complete layouts will be submitted at no charge. Heading the newly formed department is Ralph Lee, who has been associated with the Electroplating Division of DuPont in Wilmington for the past 22 years.

Fenn Enlarging

Fenn Manufacturing Co, Newington, Conn, is increasing its manufacturing area by one third. A sizable portion of the addition will be used for enlarging the assembly area of its heavy machinery division. With this new section, which will be ready for occupancy in June, the company will have 150,000 sq ft of manufacturing area for its products which include metal forming machinery, aircraft, missile, and nuclear components. Fenn has recently added a new type of deburring machine to its line.

"Maybe you don't like the tail fins for the new Gazelle, but you'll stamp 'em out just the same!"

DIAMOND WHEELS by Carborundum are most economical for carbide tipped cutter grinding. Many in-plant tests conducted on the grinding of carbide tipped cutters have proved Carborundum Diamond Wheels superior to competitive wheels in economy and grinding performance. The efficiency and savings indicated by the results of these tests are so outstanding that the details of many of them have been forwarded to Carborundum distributors and salesmen for your reference. Ask the Carborundum representative in your area to show you these facts on his next call. **CARBORUNDUM**®


Whatever you need...
Machine tools
Metal-forming equipment
Cutting tools
Abrasives
Tool holders
Inspection equipment
Portable tools
Lubricants
Controls
Electric motors
Bearings
Pumps & valves
Fasteners
Steels
...you'll find a supplier for it fast

Coming to you in the January 23, 1961 issue of American Machinist/Metalworking Manufacturing is metalworking's biggest, most comprehensive source of buying data: *the 1961 Buyers' Guide Issue.*

Whatever you need, the well-organized, easy-to-use Buyers' Guide Issue will enable you to find a buying source in a matter of minutes. With sections color-coded on special paper, with a wide range of buying information, a quick inspection of the Buyers' Guide Issue will earn it a permanent place on your desk for the whole year.

Here are the four major sections of the Buyers' Guide Issue that will go to work for you:

- **The Buyers' Guide Section** a record-sized portion of the issue that includes 39,500 listings, products of 4,500 manufacturers shown under 1,900 separate headings. The section provides sources for everything you can possibly need in metalworking manufacturing – complete with maker's name and complete address.
- **The Equipment Review Section** clear-cut, fast-reading descriptions of 1960's new products in metalworking that were reported in AM/MM's 26 issues during the year (and including the new equipment unveiled at the gigantic Chicago Exposition). For ease of use, this section is divided by manufacturing technique ("Machining," "Tooling," etc.).
- **The Metals Distributor Section** really two sections within one—to give you local sources for steel and non-ferrous metals with each warehouse shown with types stocked. Here's a handy buying reference that you'll find nowhere except in AM/MM's Buyers' Guide Issue.
- **The Machine Tool Distributor Section** where-to-buy and who-to-call data on local distributors of machine tools in principal cities shown both alphabetically and by machine tool builder represented. This section enables you to make immediate contact with the builder's local representative – a big time saver.

Advertising in the 1961 Buyers' Guide Issue will be placed (at the direction of advertisers) adjoining specific sections of the publication where it will have the greatest interest... tooling with tooling, inspection equipment with inspection equipment, etc. If more data is required, a jumbo-sized reader-service card will bring you even more information.

Metalworking's biggest, most complete source of buying data

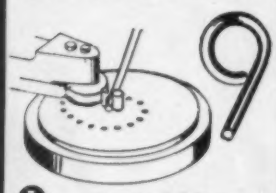
THE BUYERS' GUIDE ISSUE

American Machinist / *Metalworking Manufacturing*

Look for it on January 23, 1961

HOW TO BEND

OFF CENTER EYES

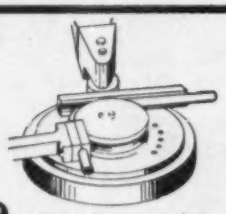


1 Insert bar stock between Locking Pin and Radius Pin of desired size.

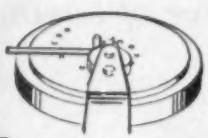
TUBING

1 Clamp tube. Insert Follow Block between material and Forming Roller.

2 Set Forming Roller against material and advance Operating Arm.



2 Advance Operating Arm until it strikes Angle Stop.



3 Complete operation with one steady movement.

3 Remove Follow Block, release clamp and remove tube.

BARS and TUBING

with a

DI-ACRO BENDER

Complete details on forming rods and tubing with standard accessories as well as tips and technical data on angle, channel and other materials will be found in "It's Easy to Bend", a 32 page summary of Di-Acro Benders and bending. A copy is yours free of charge.

pronounced die-ack-ro

Consult the yellow pages of your phone book under Machinery, Machine Tools for the name of your nearest Di-Acro distributor or write:

di-acro PRECISION METALWORKING MACHINES

O'NEIL-IRWIN MFG. CO.

405 8TH AVE. LAKE CITY, MINN.

Conklin Brass & Copper Begins Its Second Hundred Years

T E Conklin Brass & Copper Co received a Special Award of Merit from Mayor Robert E Wagner on the occasion of its 100th anniversary celebrated recently. The company is the largest independent non-ferrous warehouse in the US and one of the few industrial firms to attain an age of 100 years in New York.

Its history spans the era from Morse to missiles. Among the products for which it supplied the basic metal were the first telephone, phonograph, and telegraph transmitter, and the original bronze shingle displayed by J P Morgan when he went into business in 1861. The Civil War draft riots centered in and around its old building in 1863 where thousands of flint-lock Springfield rifles were stored.

Today the company's metal is reaching into space on missiles and satellites. In addition to copper and brass it now handles aluminum and has 7½ million pounds of metals stored in its warehouses in Brooklyn and Manhattan. The Conklin family has kept direct management of the firm through the years from its founder Theodore E Conklin to its current president, Theodore B Conklin who has headed the organization since 1947.

Big Orders for Freight Cars

Pennsylvania RR has placed orders for 3500 new cars costing $28.1 million. The cars will be built at the Hollidaysburg, Pa, shop near Altoona and all are scheduled to be ready for use by next September. Louisville & Nashville RR has authorized purchase of 1800 new freight cars. The $19.5 million worth of equipment will be furnished by Pullman-Standard and will be built at Bessemer, Ala.

Trane Expands in South

Construction has begun on a 120,000 sq-ft addition to the Clarksville plant of Trane Co, maker of residential and commercial heaters and air conditioners. When expansion is completed, employment will increase from 100 to 300 or 400.

Lyon Inc, Detroit . . .

. . . expects to complete construction of its Grenada, Miss, plant in March. The facility, which will produce auto wheel covers and hubcaps, will employ approximately 300. •

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

MACHINES AND ATTACHMENTS

1 SMALL MACHINE TOOLS — *Jones & Lamson Machine Co, Springfield, Vt.* Three illustrated bulletins provide information on 1) a precision boring machine, Model 6, applicable for high production of close tolerance turning, boring, and facing work; 2) Model 6B gun drilling machine featuring spindle speeds up to 15,000 rpm; and 3) a small thread grinder specifically designed for small-lot production. All of these machines are in the $10,000 or under price range.

2 MICROSTONING MACHINES — *Taft-Peirce Manufacturing Co, 15 Mechanic Ave, Woonsocket, RI.* 16-page catalog 319 illustrates and describes the Supfina machines and attachments. The microstoning principle is discussed; by the process it is possible to generate finishes to specifications down to 1 microinch or better, depending on material being worked. Equipment described includes the Model 86 plunge cut centerless microstoning machine; Model 88 through-feed centerless unit; accessories; and special equipment and services.

3 AUTOMATIC FOR BAR AND CHUCK WORK—*Dowding & Doll Ltd, 246 Kensington High St, London W 14, England.* 4-page brochure pictures and describes features of the new British Accuratool Automatic which allows any job to be set up with speed and feed changes and any combination of slide movements by simply plugging in electrical connections on the built-in sequence control panel. Bar capacity is 13/16 in.; center height 5¼ in.; swing over cross-slide 5¾ in. Spindle speeds (forward and reverse in four overlapping ranges) 37 to 3000 rpm.

4 CHIPLESS MACHINING — *Michigan Tool Co, 7171 E McNichols Rd, Detroit 12, Mich.* 8-page bulletin RF-60 describes and illustrates the Roto-Flo process for cold-forming splines, serrations, grooves, threads, and similar forms. Detailed illustration show Roto-Flo operation and the type of work performed.

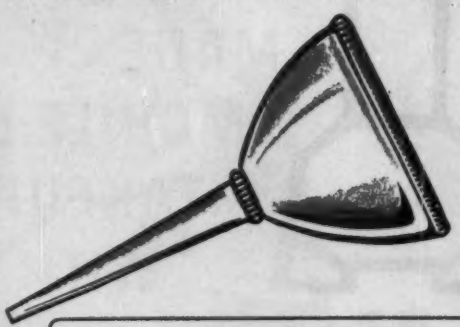
"If you don't give me a raise I'll tell everybody you did!"

JARVIS UNVEILS A REVOLUTIONARY DESIGN IN COLD FORMING TAPS!

NEW JAR-FLO

LUBE-GRUV® TAPS

LUBRICATION GROOVES MAKE CHIPLESS FORMING OF INTERNAL THREADS AS EASY AS CONVENTIONAL TAPPING!



NOW, for the first time, cold forming taps that give *full time lubrication* to the *forming contact* area during the *full* tapping cycle.

LUBE-GRUV® gives you a *far superior finish* on the formed threads than is possible with conventional cold forming taps.

USE CONVENTIONAL TAPPING EQUIPMENT. The combination of *positive lubrication* and *narrow contact* surface makes the forming of internal threads much easier than with ordinary cold forming taps. Jar-Flo with LUBE-GRUV has less drag, requires less driving torque.

LUBE-GRUV® Jar-Flo TAPS FOR CHIPLESS FORMING INTERNAL THREADS IN DUCTILE MATERIALS—STRONGER THREADS—NO CHIPS—AVAILABLE IN PLUG OR BOTTOMING TYPES

SEND FOR COMPLETE DETAILS

Jarvis CORPORATION

JARVIS CORPORATION, 104 Washington Park North Attleboro, Mass.

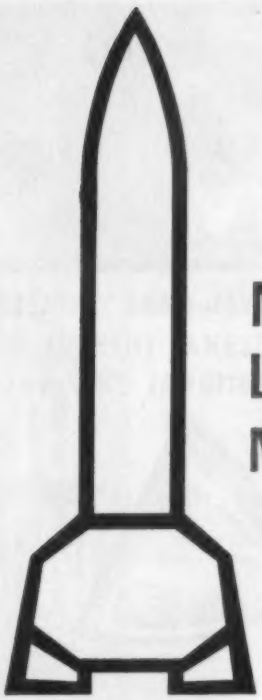
____Have Rep. call ____Rush LUBE-GRUV Brochure

Name _____ Title _____

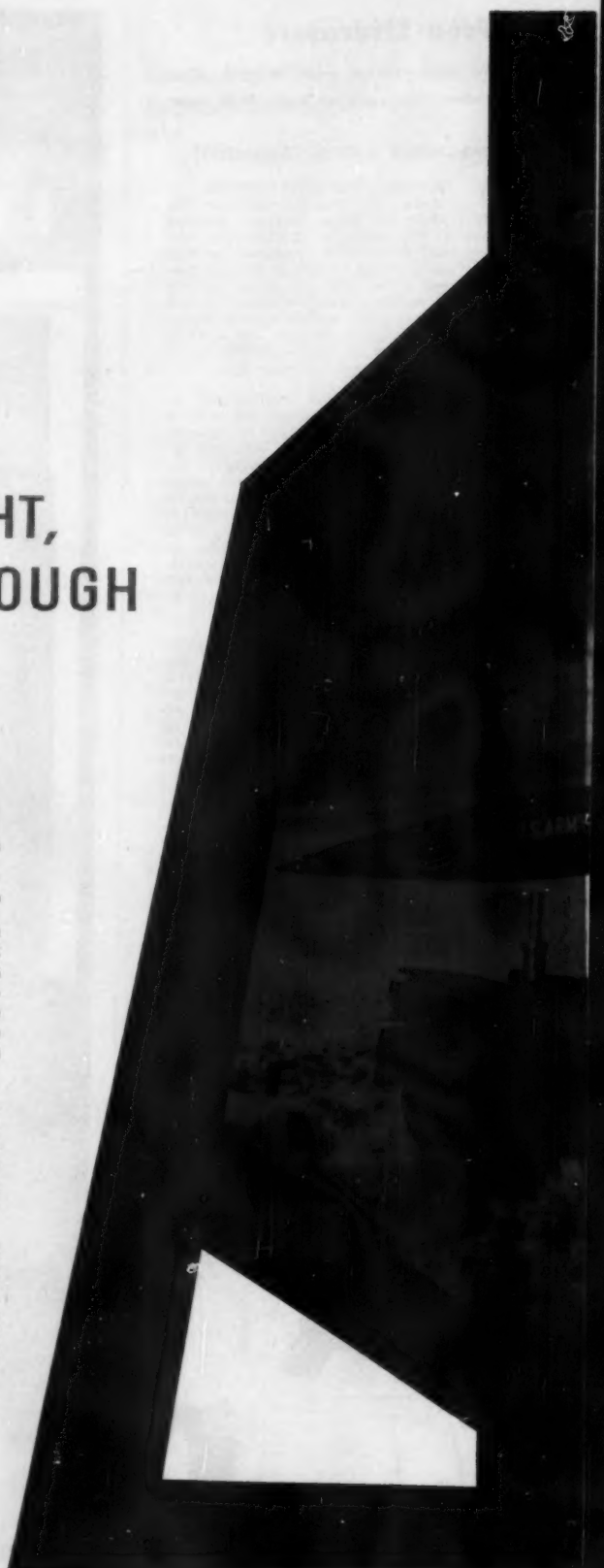
Company _____

Street _____

City & State _____



MISSILE LAUNCHER MADE MOBILE-LIGHT, TAKEOFF-TOUGH WITH N-A-XTRA HIGH-STRENGTH STEEL



A battlefield might be anywhere. Wherever it is, there may be a need for the new 10,000-pound, 36-foot Sperry-Rand U.S. Army Sergeant missile. That's why the launching station on which the missile is assembled, aimed and fired must be light enough to be transported by land, sea or air. Yet it also has to be rugged and strong enough to assure the launcher's availability for subsequent firing.

N-A-XTRA steels meet all the conditions of light weight, high strength and impact resistance. Pound for pound, they're nearly three times stronger than mild carbon steel. They are used, not only in this mobile missile launcher, but in many other defense products and in commercial equipment such as earth-moving vehicles, heavy machinery and pressure vessels.

Fabrication qualities are an N-A-XTRA bonus. Even at extreme subnormal temperatures, they remain tough and readily weldable. Conventional methods—cold forming, gas cutting, shearing and machining—give superior results, too. For further information, write Product Development Department, Great Lakes Steel Corporation, Detroit 29, Michigan.

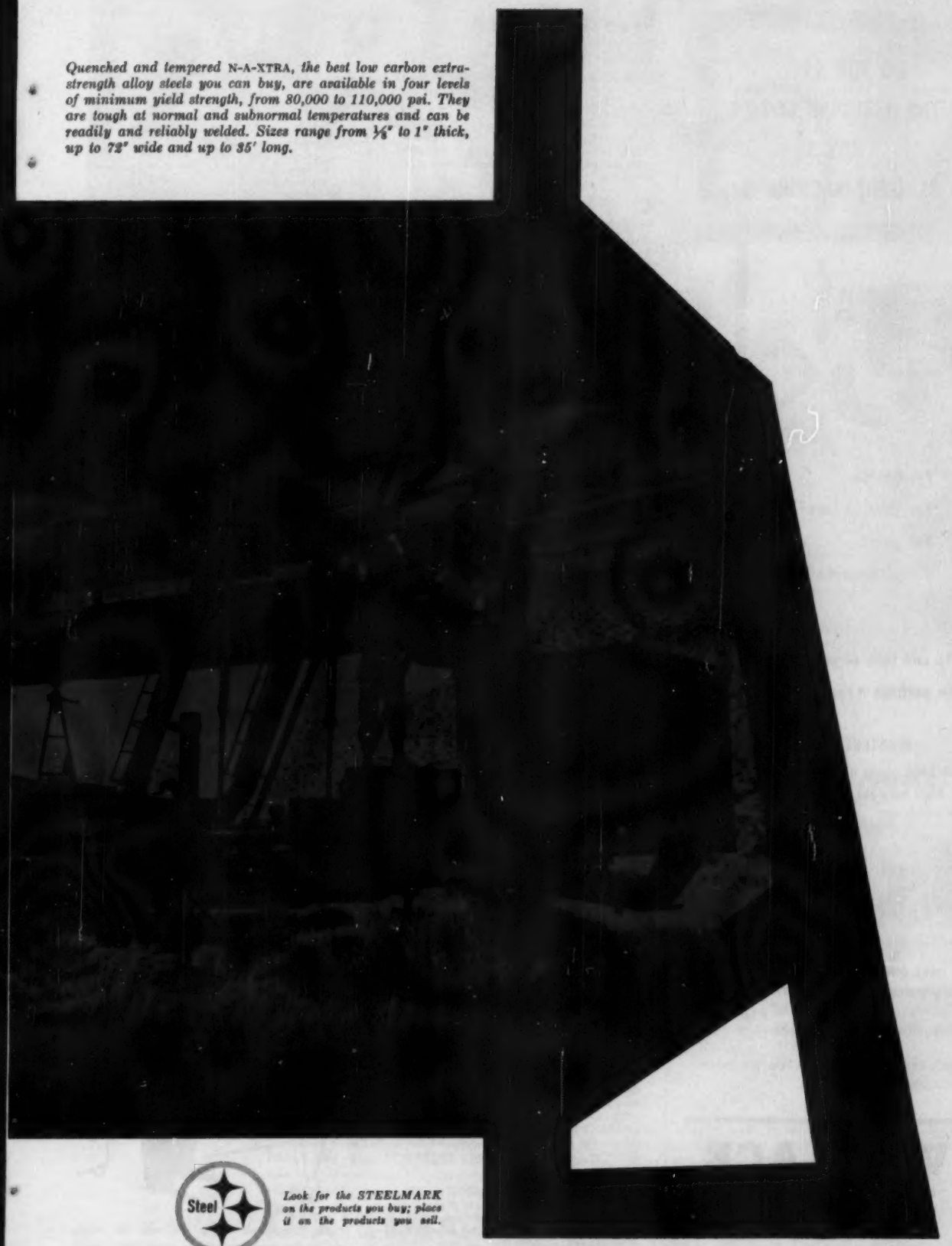
N-A-XTRA

A PRODUCT OF

GREAT LAKES STEEL

Detroit 29, Michigan

Quenched and tempered N-A-XTRA, *the best low carbon extra-strength alloy steels you can buy, are available in four levels of minimum yield strength, from 80,000 to 110,000 psi. They are tough at normal and subnormal temperatures and can be readily and reliably welded. Sizes range from ⅛" to 1" thick, up to 72" wide and up to 35' long.*

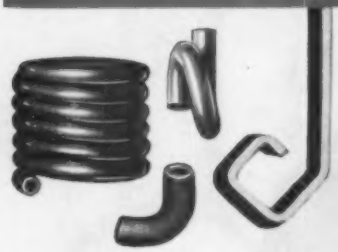


Steel

Look for the STEELMARK on the products you buy; place it on the products you sell.

***Great Lakes Steel is a Division of* NATIONAL STEEL CORPORATION**

DO YOU HAVE THE ASSIGNMENT TO "BUY A BENDING MACHINE"?



For bus bars?

For thinwall tube?

For pipe?

For structural shapes?

Or is it a rolling machine?

To coil tube or pipe sections?

Or perhaps a ram bender?

WHATEVER IT IS . . .

WALLACE — with over 64 years in the field — could help you in this important job!

CALL COLLECT BUckingham 1-7000

For over 20 years **ED PTACK'S JOB** has depended on how well he — and those working with him — matched machines to the jobs of thousands of Happy Wallace Bender users!

Best proof of how well he does?
CALL HIM!
He's here! He's waiting to help you before you commit yourself!

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SUPPLIES MFG. COMPANY
3510 N. Ravenswood Avenue
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(Collect, as we said before)
Chicago 13, Illinois

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

Ways of obtaining increased output, material savings, finer surface finish, stronger parts, longer fatigue life, longer tool life, and reduced secondary operations are illustrated.

5 AUTOMATIC DIE PROTECTION—*Wintriss Inc, 20 Van Dam St, New York 13, NY.* 4-page bulletin offers information on the Circuit Master Mark III Press Overload Detector designed to work with presses that range up to 1000 strokes per minute. Lowcost unit protects against die and press damage caused by doubles, misfeed, buckling, thickness variations, and pileups; it provides instant visual indication of press malfunction and correct operation. Construction, application, and installation details are shown.

6 PNEUMATIC CLUTCH AND BRAKE—*Federal Machine & Welder Co, Warren, Ohio.* Bulletin 52100 illustrates and describes the WARCO unit designed for use as replacement equipment on all makes of presses.

TOOLS AND ACCESSORIES

7 AIR TOOLS—*Aro Equipment Corp, Industrial Division, Bryan, Ohio.* 96-page catalog 64 covers complete line of air tools, power motors, and accessories including many recently introduced products. New line drawings with tabulated dimensions have been provided for self-feed drilling units and air hoists. New section featuring technical data applicable to the general line is included.

8 METALLURGICAL MICROSCOPES —*Elgeet Optical Co, 838 Smith St, Rochester, NY.* 8-page booklet EM-960 contains detailed, illustrated information on three models. Features, applications, components covered.

9 AUTOMATIC LUBRICATING SYSTEM—*Bijur Lubricating Corp, Rochelle Park, NJ.* 4-page bulletin CL gives details on three types of a new Circulube automatic system which provides positive control of oil feed and circulation rates. Includes both photos and engineering drawings to illustrate product data and specifications. Pressure signal switch in the system makes it impossible for the machine to be operated unless it has adequate lubrication.

10 JIG AND FIXTURE COMPONENTS—*Northwestern Tools Inc, 114 Hollier Ave, Dayton 3, Ohio.* 16-page catalog 31 includes full-scale tracing templets of Northwestern jig and fixture components and lists and gives tabular data on over 300 clamping items. Also includes the names, addresses, and telephone numbers of 64 stocking distributors throughout the US and Canada.

11 DIAMOND WHEELS — *O'Rourke Diamond Co, 11411 Vanowen St, North Hollywood, Calif.* 16-page catalog contains profiles and prices of the latest type of diamond wheels and hones. Featured are a full line of resinoid-bond wheels with natural or man-made diamond for smooth finishing, and special metal-bond wheels for electrolytic grinding. Latter are available with diamond or non-diamond abrasive.

12 MACHINING CONCENTRATE — *Baker/Gubbins Co, 1443 Wabash Ave, Detroit 16, Mich.* Data sheet contains information on Compound 776-W, a water-soluble concentrate for use in tube finning, tube roll forming, and broaching. Product is said to offer the optimum in cooling ability, cleanliness, and low cost for aluminum, brasses, cupro-nickels, carbon steel, and stainless. It need not be removed to perform brazing operations and may be used with all types of filtering systems.

13 FLEXIBLE SHAFT ASSEMBLIES —*F W Stewart Corp, 4211-13 Ravenswood Ave, Chicago 13, Ill.* 8-page bulletin, Form 574, provides data on Circle Ess Standards, a group of standard flexible shaft assemblies made of steel cable and vinyl covered steel casing, with cadmium plated steel end fittings. These shafts can be quickly assembled from stock. Two types are offered 1) Mono-directional, used basically for motor driven or high speed applications; 2) Bi-directional, used primarily for hand operated control applications.

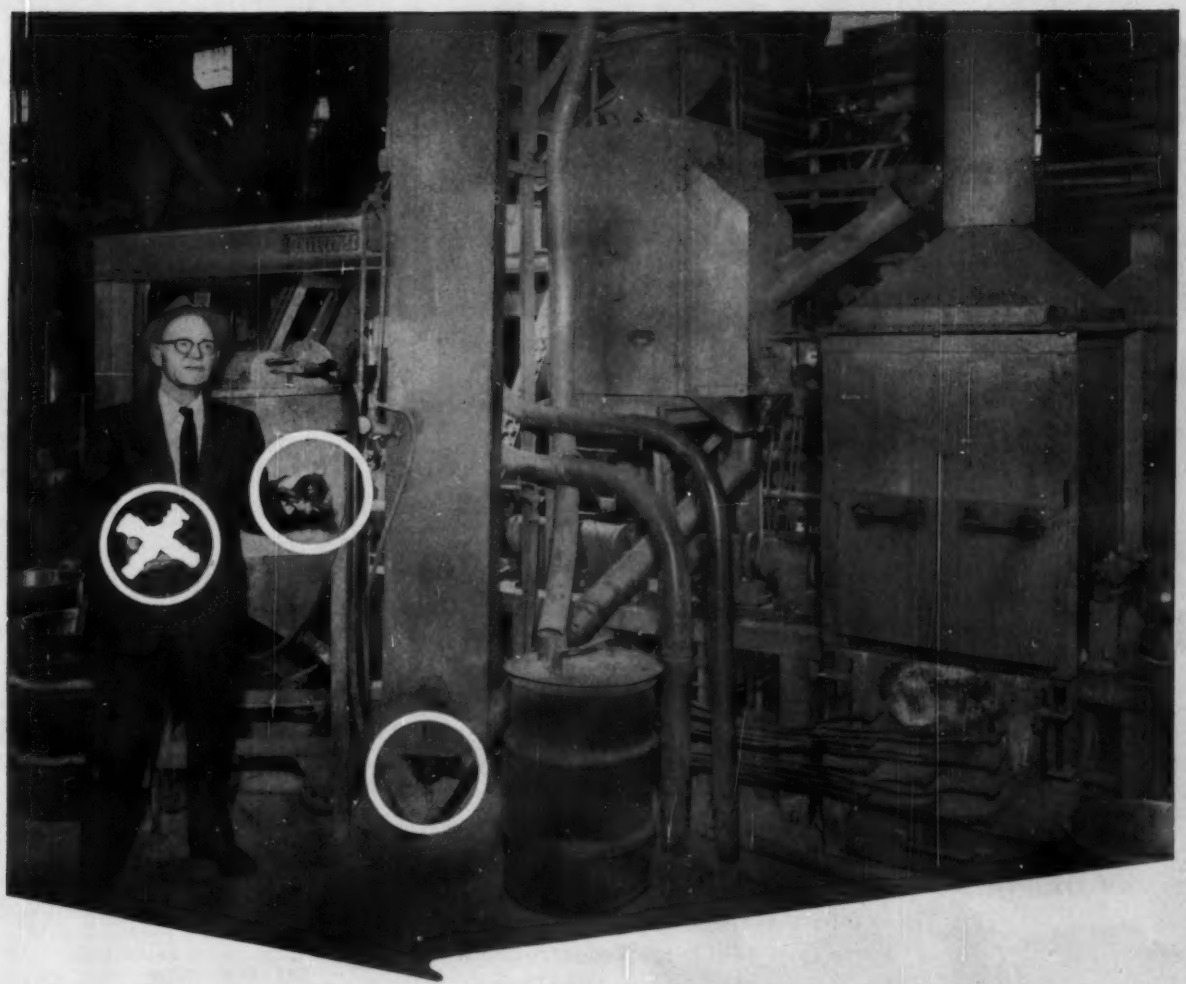
14 "MODERN THICKNESS TESTING" —*Twin City Testing Corp, 533 S Niagara St, Tonawanda, NY.* Brochure contains description of the various non-destructive methods currently employed for measuring the thicknesses of organic and non-magnetic metal coatings (including phosphate) on iron and steel. Advantages and limitations of each method are discussed in the light of thickness measuring instruments now available.

15 ROLL GRINDING WHEELS—*Macklin Co, Jackson, Mich.* 4-page brochure describes the desired wheel characteristics required for all types of modern roll grinding, including good balance, fast cutting action, and rapid stock removal. Photos of various types of these wheels are included as well as case histories for grinding such materials as hot mill work rolls, cold mill work rolls, and cast steel back-up rolls. Complete wheel recommendations included.

16 SPECIAL TOOLS — *Xcelite Inc, Orchard Park, NY.* 4-page bulletin 660 covers highly specialized hand tools, custom-made, to cope with unusual assembly and service problems where conventional hand tools prove inadequate. While most were specially designed for the application, some represent modifications to standard Xcelite tools.

17 DIE ASSEMBLER — *Producto Machine Co, 990 Housatonic Ave, Bridgeport 1, Conn.* 2-page bulletin describes Model DA-1-P for handling dies during assembly or maintenance. Maximum load is 2000 lb; die closing force, 3000 lb; and separating force 1500 lb.

"Your boy friend left a message. He wants you to be sure and bring home some more pens, pencils, envelopes, paper, erasers, clips, and carbon paper."



Bearings, Inc. recommended a better seal, a better bearing and savings are $700.00 a year!

Here's a maintenance foreman who knew where to get help when bearings in his care failed prematurely. He called a Bearings, Inc. engineer when the bearings in this bucket elevator conveyor failed after only two weeks of use.

The Bearings, Inc. engineer found that the powdered zinc transmitted by the conveyor was responsible for the failure. Powdered zinc had worked through the bearing seal and since zinc joins itself when rubbed between two surfaces, being rubbed between the balls and bearing race led to a build-up that stopped the bearings in their tracks.

Analysis of loads and speeds showed a less expensive bearing would work well if its seal would shut out all dirt. The original bearings cost $16.79 each — the replacement only $7.36! This meant a net saving of $700 in bearing costs alone. Now in operation for two years the bearings have been replaced only once.

Bearings, Inc. sales engineers sell only products we are authorized to sell. No deals, no "just as good as" substitutes. Call the branch nearest you — The bearings you want are in stock ready for delivery.

Providing bearing service in the North → **BEARINGS, INC.**

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in the South → **DIXIE BEARINGS, INC.**

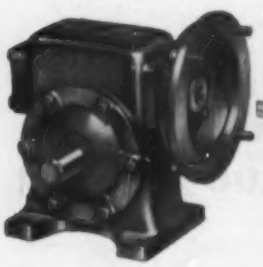
ARKANSAS: Little Rock • **FLORIDA:** Jacksonville • **GEORGIA:** Atlanta • **KENTUCKY:** Louisville • **LOUISIANA:** Baton Rouge New Orleans • **N. CAROLINA:** Charlotte • Greensboro • **S. CAROLINA:** Greenville • **TENNESSEE:** Chattanooga • Kingsport • Knoxville Memphis • Nashville • **VIRGINIA:** Norfolk • Richmond • Roanoke

956

different
motorized
speed reducers

available from stock

Yes! 956 different combinations of Perfection Motorized Worm Gear Speed Reducers are available for immediate delivery, *from stock.* Ratios range from 5 to 1 to 60 to 1, in capacities from 1/6 H.P. to 5 H.P. Perfection "C" Flange Reducers may be ordered complete with motor or without motor, to be used with a motor *of your own choice.*



Flanged motor reducers offer the maximum in compactness, rigidity and adaptability. Through the use of standard NEMA face mounted motors, complete interchangeability between motors is provided. Motor maintenance is possible without disturbing the drive and reducer. Motor assembly is fast and positive with no alignment problems.

Write for your free copy of our new 28 page catalog containing illustrations, charts and tables to help you choose the right Reducer for your particular application. Ask for Bulletin No. M-140.

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PERFECTION GEAR COMPANY, HARVEY, ILLINOIS

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

18 PRESSURE AND TEMP CONTROLLERS — *OPW-Jordan, 6013 Wiehe Rd, Cincinnati 13, Ohio.* 6-page catalog J-C covers pneumatic devices that control pressures up to 10,000 psi and temperatures from −125 to 1000 F. Describes features and accessories and gives dimensions, specifications, materials of construction, and complete engineering information.

HEAT TREATING AND WELDING

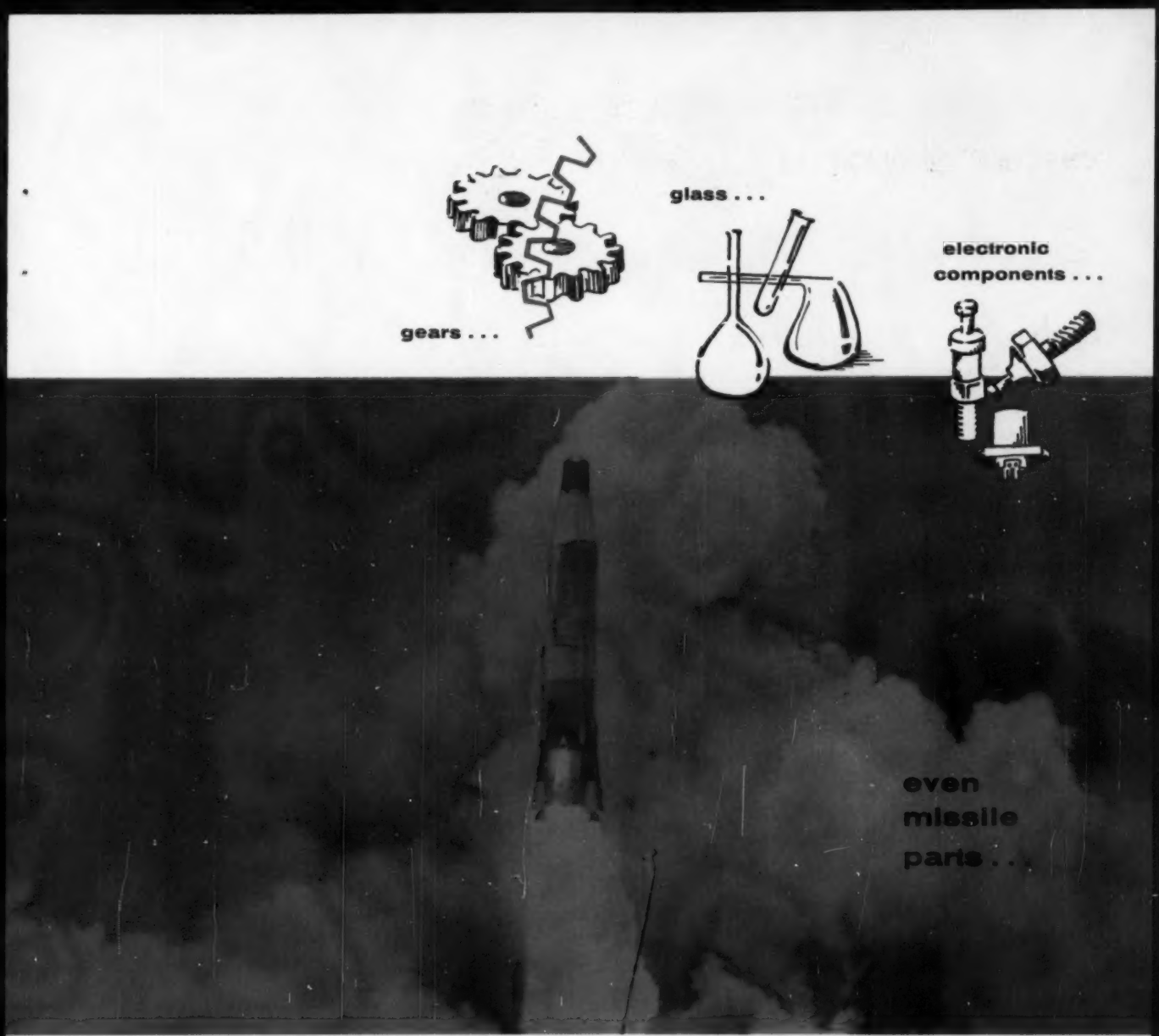
19 FURNACE EQUIPMENT — *Sunbeam Equipment Corp, 130-11 Mercer St, Meadville, Pa.* 6-page bulletin SEC-11 covers full line of Sunbeam standard pre-engineered industrial furnace equipment for heat processing. Selection guide simplifies choice of proper type in relation to particular processing requirements.

20 SOLDERING IRONS—*General Electric Co, Schenectady 5, NY.* 4-page bulletin GEC-1545 describes complete line of production soldering irons for use on all electronic equipments, meters, and instruments. Discusses special irons and transformers for soldering printed circuits, transistors, and miniature and subminiature components for aircraft and missile assemblies. Irons are rated at 6, 115, 120, and 230 v, 12 to 1250 w.

21 WELDING ACCESSORY — *Lincoln Electric Co, Cleveland 17, Ohio.* 4-page bulletin 5205.2 provides information on operating features, construction, and application of the Squirtmobile, a trackless carriage for Lincoln's semi-automatic Squirt welder. Designed to make long welds, this magnetically supported travel unit is said to introduce a new degree of portability and flexibility previously unavailable in submerged arc welding.

22 SPECIAL PRODUCTION EQUIPMENT—*Kirkhof Manufacturing Co, 2430 Buchanan Ave, Grand Rapids, Mich.* 8-page bulletin E60-1 pictures and describes resistance welders custom designed and with standard frames specially tooled; arc welders; welding guns and stations; and resistance heating equipment.

"There'll probably be the devil to pay in the treasurer's office one of these days, but I found an extra ten thousand dollars in my pay envelope this afternoon."



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CAN CLEAN ALMOST ANYTHING!!

Vast and varied are the proven applications for Circo ultrasonic cleaning units — the amazing machines that bombard with sound to blast dirt loose, yet never harm your product. They achieve precision cleaning — **absolute cleanliness** — in mere minutes or less!

Wherever absolute cleanliness is a must, or where cleanliness creates a production bottleneck — there's a need for Circo ultrasonics.

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WHAT'S YOUR LINE?

CIRCO *ultrasonic* CLEANING UNITS

achieve precision cleaning. . . in seconds!

Circo Model BC2500

Complete generator and tank • electrically tuned • average 3,000 watts output • side- bottom mounted ar

No matter what you make — no matter how large or small your product is — you'll find that Circosonics® saves you time and money while achieving absolute cleanliness.

Circo ultrasonics has proven to be a master at removing excess solder flux, finger prints, polishing compounds, lint, waxes and other contaminants from jewelry, lenses, ceramics, relays, printed circuits, glass, hollow needles, gyro components, gears, clocks, meters — to name but a few.

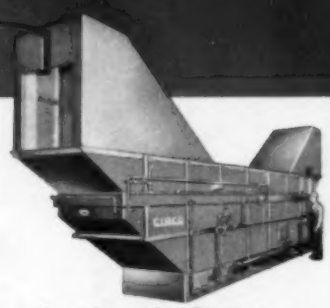
Whether you need a bench model, or a huge custom-designed conveyorized system, Circo engineers can recommend the specific Circosonic® unit to solve your problem. Circo, you see, offers the widest line of ultrasonic units to be found anywhere.

HAVE YOU READ THIS FREE BOOK?

New, free book — "Tips on Ultrasonic Cleaning" — contains complete, factual information about ultrasonic cleaning. Tells how it works, contains proven applications, etc. Tear off and mail the air mail reply card — today — for your free copy.

Mesh Belt Washer

Here is one example of the Circo family of Washers that are used throughout industry. Circo's extensive experience in the field is your assurance of getting the exact piece of equipment to fill your needs. Monorail, Agitating, Cabinet type machines • Low operating costs • High speed production • Completely engineered phosphatizing systems have long been a specialty at Circo.



Large Conveyorized Degreaser

Custom-built Circo Conveyorized Degreaser chalks-up big savings for Purolator Products Inc., Wayne, Mich. Linked-up with the production line, this giant Degreaser super-cleans filter parts and speeds them on their way in record time, at lowest per unit cost. This unit is simple to operate, easy to maintain, and operates on a continous production line basis.

Gentlemen:
Please rush to me my free copy of "Tips on Ultrasonic Cleaning."

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I would like further information about:

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Free Literature

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PLANT SERVICE EQUIPMENT

23 HORIZONTAL CONVEYORS — *Rapids-Standard Co, 342 Rapistan Bldg, Grand Rapids 2, Mich.* 8-page bulletin 19-1200 pictures and describes five types of power conveyors: APC (Adjustable Pressure) conveyor in wheel and roller models; live-roller conveyors; belt-on-roller conveyors; table conveyors; and turntable units. Specifications included for all.

24 STRAPPING TOOLS AND SUPPLIES—*A J Gerrard & Co, 400 E Touhy Ave, Des Plaines, Ill.* 60-page, spiral-bound, thumb-indexed general catalog covers automatic strapping machines, manually operated strapping tools, strapping, seals, and accessories. Contains strapping recommendations for light, medium, and heavy-weight packages, cartons, bundles, boxes, and crates.

25 BENCHES AND BINS—*Bay Products Inc, 1301 W Cambria St, Philadelphia 32, Pa,* 32-page catalog illustrates and describes complete line of benches, bins, cabinets, shelving, stock carts, and special accessory equipment. Features of new modular benches discussed and pictured. Specifications and prices included.

26 PUSHBUTTON STATIONS — *Clark Controller Co, 1146 E 152nd St, Cleveland 10, Ohio.* 8-page bulletin PL-100-1-960 contains illustrated information on pushbutton stations and control units. Covered are: pushbutton units; selector switch units; standard pilot lights; and push-to-test pilot lights or lighted pushbuttons. Sequence description is given of the wipe-action contacts. Color selection chart shows available combinations of seven colors for color coding both buttons and ferrules in the control units.

PARTS AND MATERIALS

27 CLAMPS—*Aeroquip Corp, Marman Division, 11214 Exposition Blvd, Los Angeles 64, Calif.* 44-page catalog 803 contains full product information on complete line of band clamps, hoist clamps, couplings, flanges, and V-Band joints for all types of applications. Detailed design information given as well as dimensional and operating data.

"I don't know what's come over me lately—several times recently when one of my men comes to me with a complaint, I've actually caught myself listening to him."

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To order any of these bulletins, circle corresponding number inside back cover.

28 INDUCTION MOTORS — *Century Electric Co, 18th & Pine Sts, St Louis 3, Mo.* 12-page bulletin contains information on squirrel cage induction motors in basic drip-proof designs. Covering horsepower ranges from 1 to 150, it discusses applications; performance characteristics; mechanical design variations; construction details; insulation; ratings; and dimensions.

29 VARIABLE SPEED DRIVES—*Graham Transmissions Inc, Menomonee Falls, Wis.* 8-page bulletin 551 pictures and describes units from 1/15 to 5 hp. Shows where and how to use this infinite range, variable speed drive. Principles of operation discussed; special controls for a wide variety of speed control systems are covered, and complete ratings and dimensions are provided.

30 PROTECTIVE COATING FOR MILD STEEL— *M L Sheldon & Co, Nickel-Over-Steel Division, 350 Lexington Ave, New York 16, NY.* 8-page brochure describes how Niphos nickel-alloy-bonded steel pipe and tubing are being used to counter corrosion and iron contamination. Applications and advantages discussed.

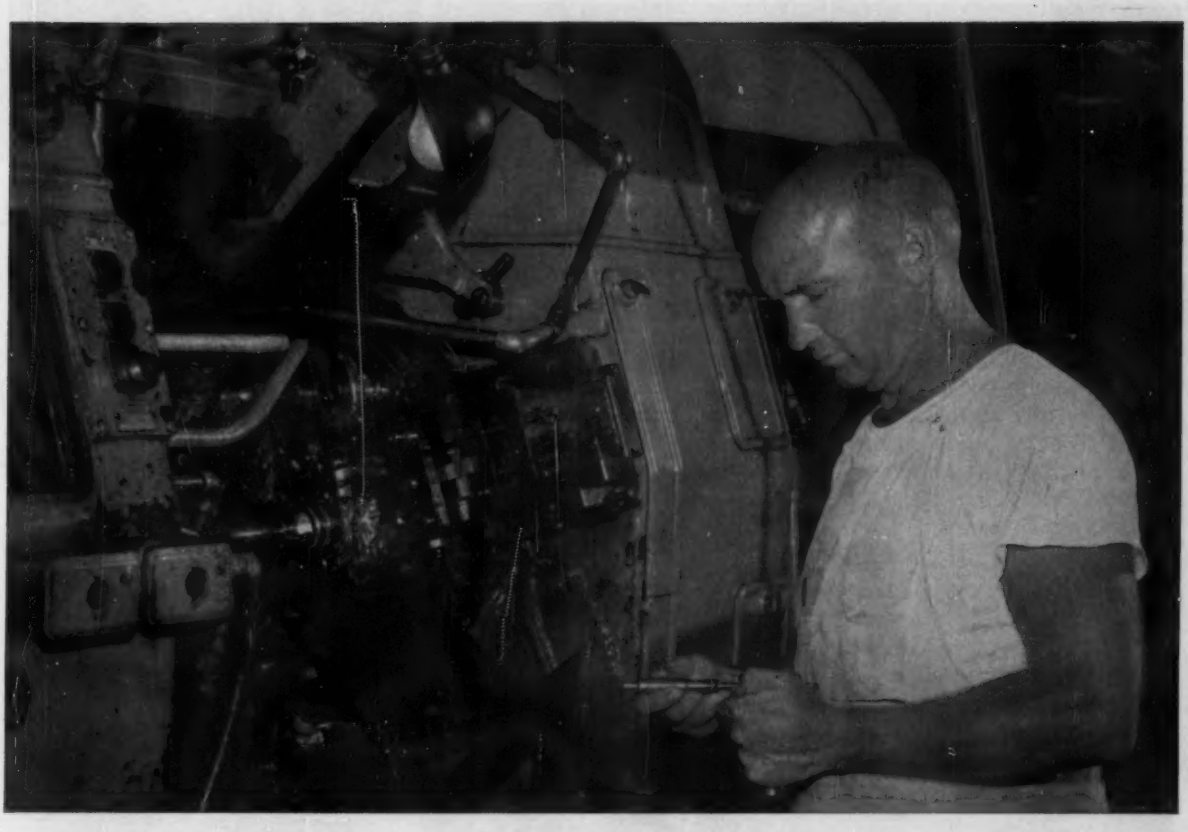
31 CAST-TOOTH SPROCKETS—*Link-Belt Co, Prudential Plaza, Chicago 1, Ill.* 12-page handbook 2867 lists stock sizes. Complete range of types and sizes permits selection from over 30,000 items in stock. Basic types are illustrated and described.

32 COMPONENTS—*Servo-Tek Products Co, Surplus Division, 1086 Goffle Rd, Hawthorne, NJ.* 30-page catalog 75 pictures and provides information on synchros; ac and dc motors; servo motors; inverters; actuators; geared motors; generators. Curves of servo motors, circuit diagrams, and schematics included.

33 SPIROID GEARS—*Pic Design Corp, 477 Atlantic Ave, East Rockaway, Long Island, NY.* 24-page catalog 22 covers new line of precision spiroid gears. Contains specifications, detailed drawings, and prices. Lists advantages and applications.

34 STAINLESS STEEL PLATE AND PRODUCTS—*G O Carlson Inc, Dept A, Thorndale, Pa.* 12-page illustrated bulletin describes how the company provides a specialized service in manufacturing stain-

"Matching wits with our electronic computer again, Brown?"



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In one month they were convinced. By using Cleartex on both cutting and lube sides they solved their problem —no more dilution of cutting oil. And look at the results: Tool life increased 20%; actual monthly savings on oil of $100; less carry-off on chips; cleaner machines; fewer rejects; happier operators and delighted management! No wonder they switched entirely to Cleartex and are now regular users of 10 drums a month!

Why not send for your copy of Texaco's new booklet —"Cleartex in Automatic Screw Machines." This illustrated guide will show you how to end dilution of cutting oil—and the profit-draining costs in rejects and tool life it causes. Just mail the coupon. Or if you want immediate savings, ask to have a Texaco Metalworking Engineer set up a test in your plant—on one machine, or on your whole line.

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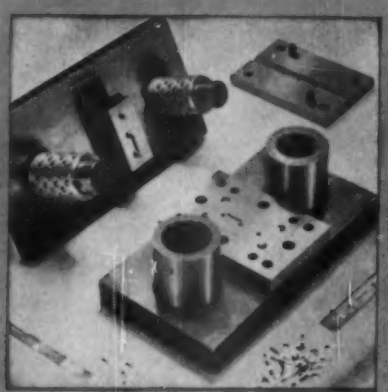
Punched Holes, .001" Diameter



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less steel plate and related stainless products. Typical applications illustrated and described. Table shows the standard and superior types of plate, including the precipitation-hardening grades, that are in Carlson's mill inventory or available on order. Basic production limits in manufacturing plates, heads, forgings, rings, circles, and flanges, as well as inventory information on bars and sheets (No. 1) Finish) are included.

35 FLEXIBLE CUSHION COUPLINGS —*Dodge Manufacturing Corp, Mishawaka, Ind.* 20-page bulletin 901 describes two new types of Para-flex units—one for high-speed, high-torque applications and another for attachment to flywheels of internal combustion engines. Engineering data, photos, dimensions drawings, and selection tables included.

36 FASTENERS—*Chase Brass & Copper Co, Waterbury 20, Conn.* 28-page catalog CK-17 lists complete line of bolts and nuts, cap and machine screws, washers, cotter pins, nails and tacks, rivets. Most are available in Silnic Bronze as well as other commonly used alloys.

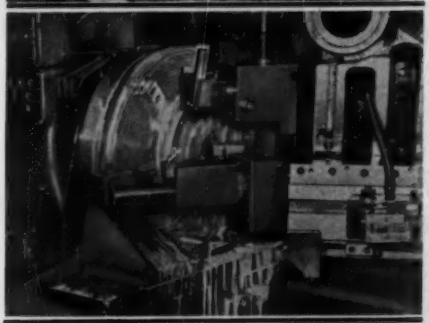
37 ROD ENDS AND SPHERICAL BEARINGS — *Heim Co, Dept AM, Fairfield, Conn.* 6-page bulletin gives catalog listings and engineering data on products lined with DuPont Teflon. Discusses advantages of Teflon linings in Unibal rod ends and palin spherical bearings, sizes available, and load ratings.

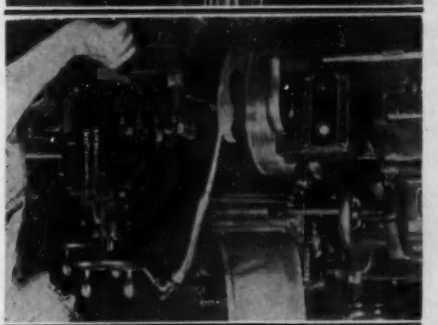
38 ALL-METAL SEAL—*Wiggins Connectors, E B Wiggins Oil Tool Co, 3424 E Olympic Blvd, Los Angeles 23, Calif.* 4-page condensed brochure summarizes engineering features of Bar-X seal which seals at extreme temperatures (−450 to +1200 F) and withstands peak pressures of 40,000 psi. Typical applications described.

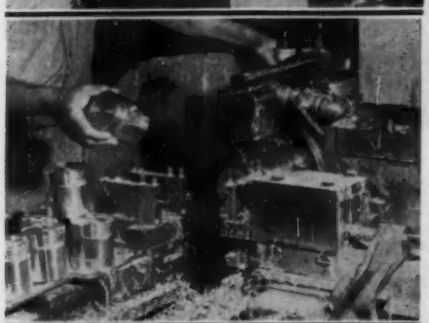
39 STEPPING SYNCHRONOUS MOTORS — *Superior Electric Co, 83 Laurel St, Bristol, Conn.* 4-page Slo-Syn data sheet No. 1 explains use of these motors as dc stepping units. Discusses and shows graphically the stepping principles of permanent magnet type motors. Contains diagrams and speed-torque characteristics charts. Details of bifilar motors described.

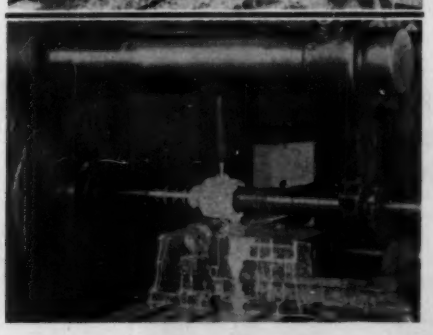
40 SWITCHES — *Micro Switch, Freeport, Ill.* 4-page Form 84-441 gives data on an adjustable pulse switch, center neutral limit switch, and a proximity switch. Applications illustrated. ●

"I don't know what it is! I keep getting this prickly feeling in this arm!"









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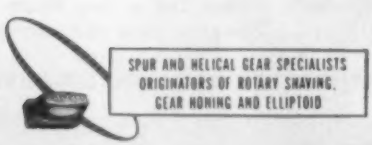

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NEW BOOKS...

STATICS & STRENGTH OF MATERIALS—*By Milton G Bassin and Stanley M Brodsky (New York City Community College). Published by McGraw-Hill Book Co, 330 W 42nd St, New York 36. 354 pages. Price $7.00*

Strength of materials without calculus, on a junior-college or extension-course level, should also be useful in the shop—and for refreshing engineers who need a light brushup. The book is strong on definitions, and is suitable for anyone with a high-school background.

The text is based on Leigh & Mangold's "Practical Mechanics and Strength of Materials," but has been rewritten and equipped with new tables, drawings, and many new problems—with answers to some. The appendix includes the usual run of tables such as properties of materials, beam shapes, and a list of formulas.

Subjects covered include forces, moments, stresses, friction, properties of materials, joints, beams, shafts, and combined stresses.—*CDE*

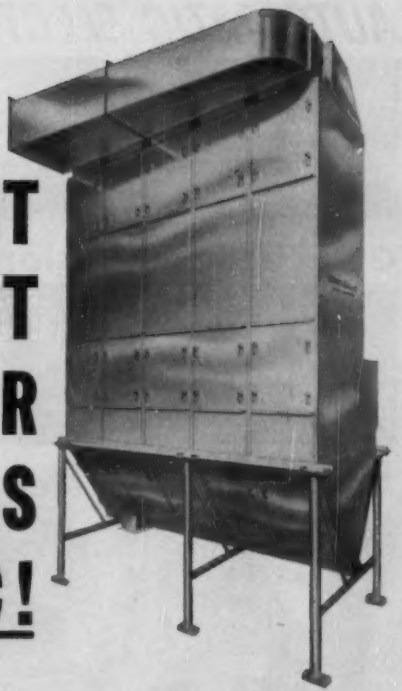
•

ULTRASONICS — *By Benson Carlin, executive vice president, Circa Ultrasonic Corp. Published by McGraw-Hill Book Co, 330 W 42nd St, New York 36. 309 pages. Price $11.50*

One of the interesting points about this book is that its first edition (it is now a second edition) was published in 1949, which seems rather a long time ago for ultrasonics; but

"OK, I got'er welded—now how do I get out?"

NEW TORIT DUST COLLECTOR IS AUTOMATIC!



Save real dollars with the benefits from this *automatic* dust collector. No more interruptions on production lines! Maintenance problems are practically eliminated. This all new continuously cycling TORIT dust collector *automatically* cleans your air and *automatically* shakes its own filters and blows them clean with reverse air flow. Collected material is emptied *automatically*.

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- automatic filter-shaker mechanism is simple, maintenance-free
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- highest air-to-cloth ratios (from 5 to 25:1) and longer filter life
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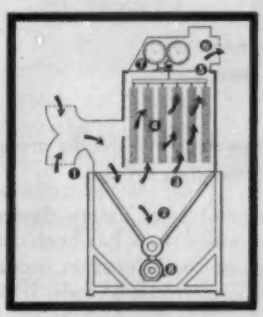

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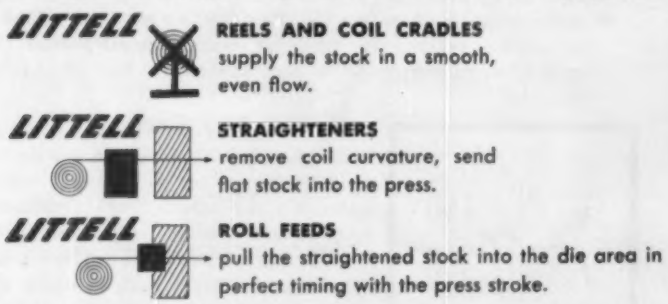
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the principle has gone through a great amount of development since that date. The book has been updated to include new material on ultrasonic testing, cleaning, welding, soldering, and medical applications.

Although this is not a history of the ultrasonic field, the book starts with basic principles and develops through crystals, generators, transducers, power, measurement, testing, and applications.

The text is well written in not-overly-technical language, though all special terminology for ultrasonics is applied. There are a fair number of sketches and drawings; only a few photos; and some equations, but most of these are quite simple. It is a good, solid reference text for anyone in engineering or production who wants to know principles and up-to-date technology.

•

APPLIED ENGINEERING MECHANICS—*By Alfred Jensen and Harry H Chenoweth (University of Washington, Seattle). Published by McGraw-Hill Book Co, 330 W 42nd St, New York 36. 409 pages. Price $6.50*

This is a second edition of a book on basic engineering mechanics that applies to any branch of engineering. New material in this edition includes coverage of belt friction, hydrostatic loads, retaining walls, suspension cables, and walls. In the dynamics section, there is new material on noncentroidal rotation, dynamic equilibrium of plane motion, and on impact and impulse.

Applied engineering mechanics is the study of forces and motion; the text develops from simple forces into centroids and inertia, and through

"I knew you were kidding when you told Mommy that your boss was two-faced."

Note minimum clean-up necessary between casting of this 6-tooth pump impeller and finished part. (Illustrated parts are 4" in diameter.)

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plane, rotary, and stopped motion.

As usual in this kind of college-level textbook, there are plenty of sketches and drawings that illustrate the principles, plus problems at the end of each section.

The writing is textbookishly stiff, which is evidently necessary in any textbook. However, there is no rambling; many of the basic principles are simply stated, then illustrated with sketches—and these are generally quite good.—*CDE*

•

PROBLEMS IN ENGINEERING DRAWING (SERIES V)—*By A S Levens & A E Edstrom. Published by McGraw-Hill Book Co, 330 W 42nd St, New York 36. Size 10 x 12 in. 39 pages. Price $5.50*

This workbook in engineering drawing is keyed to French & Vierck, "A Manual of Engineering Drawing for Students and Draftsmen" (9th edition) and to "Fundamentals of Engineering Drawing." It is a laboratory or classroom exercise manual in lettering, view construction, sketching, sectioning, projection; and includes a section on American drafting standards. As such, it is a useful classroom aid for college engineering students.

In addition to sketches and drawings that show the correct way to draft, it includes many work pages (that simulate vellum paper) for practice and test.

•

CHIPLESS MACHINING—*By Charles H Wick, former managing editor, Machinery magazine. Published by The Industrial Press, 93 Worth St, New York 13. 502 pages. Price $10.00*

Subtitled "Methods of cold-forming ferrous metals, including heading, rolling, spinning, swaging, extruding, and high-energy-rate forming," the book is a reference work on how these forming methods work, how parts must be designed for them, and the economies of working rather than removing metal. It is a guide for planning and tooling for chipless machining.

Processes covered include spline and gear rolling, radial forging, spinning, and rotary swaging. Plastic deformation of metals and their properties are covered.

The book is liberally sprinkled with illustrations that include die designs. •

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Here's the newest STRIPPIT Mobile Demonstrator Unit, equipped with actual operating STRIPPIT metalworking equipment. Every day, throughout industrial America, we welcome aboard scores of production men and company executives for on-the-job proof that the STRIPPIT way is the most efficient and economical way to punch holes.

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The STRIPPIT Flex-O-Drill (bottom) eliminates the need for base line drawings and vernier height gage layouts in the production of precision templates and sheet metal layouts. Also on display in the Demonstrator are a variety of STRIPPIT self-contained hole punching units.

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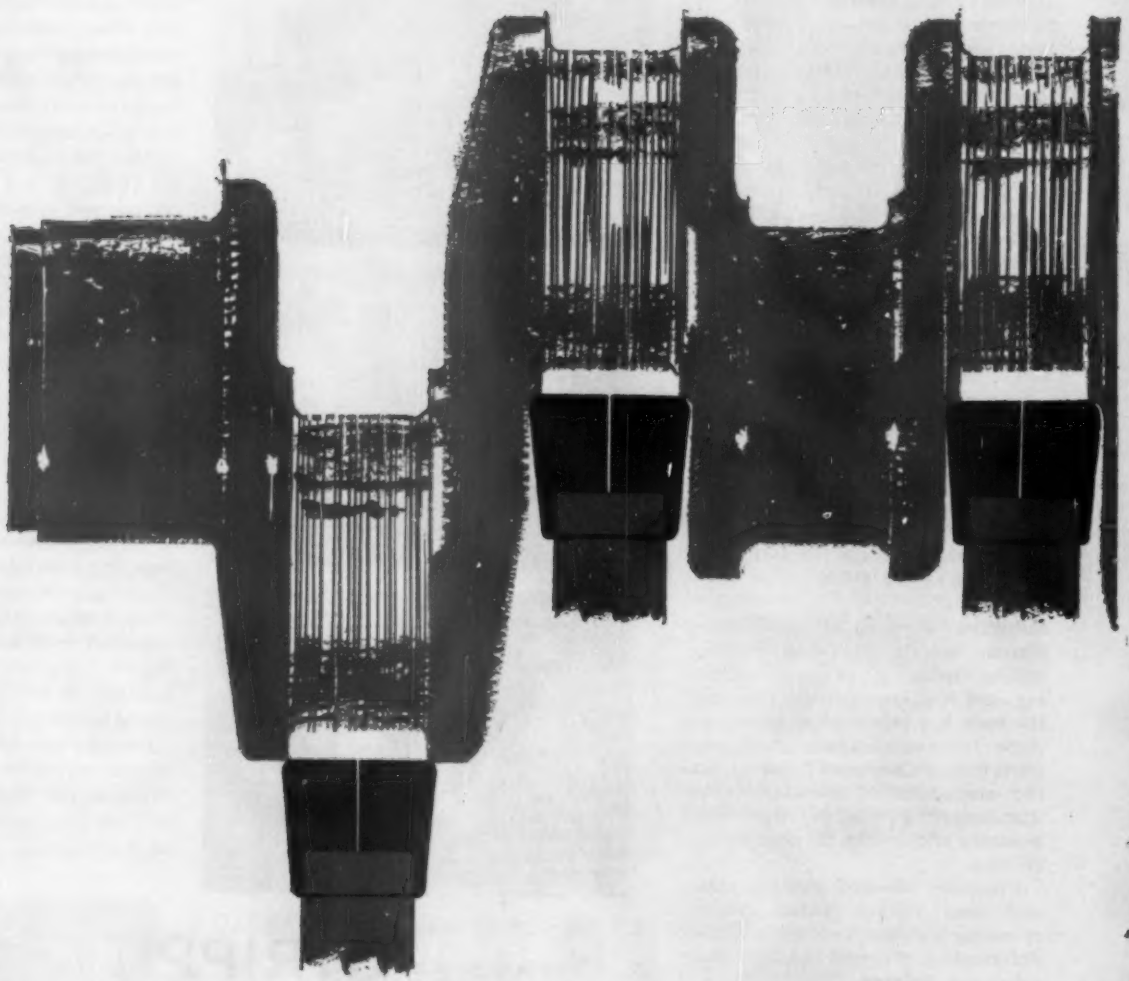
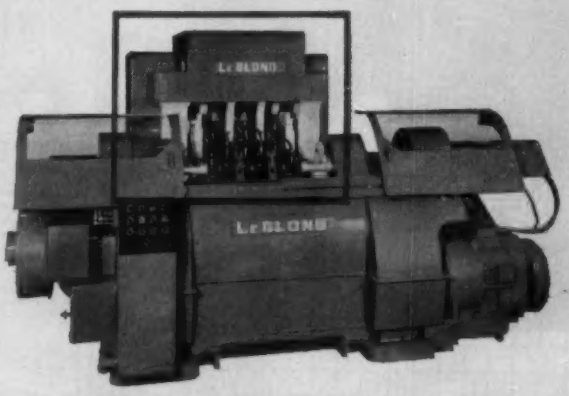


The R.K. LeBlond Machine Tool Company, Cincinnati 8,

TOOLING

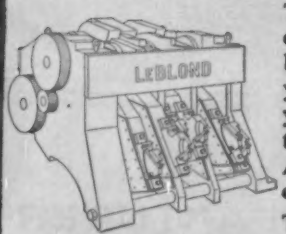


A new concept in crankshaft turning

Automatic machining plus quick and easy tooling change-over—this is the unusual combination of advantages of our new 6PC Pin Turning Lathe.

All tooling, slides and master crankshafts are contained in a package unit which can be removed and a new tooling package installed in a few hours.

By this "package tooling" concept we eliminate the time delay heretofore required to send crankshaft machines back to the manufacturer for rebuilding. In addition, capital outlay is substantially less when you purchase a new tooling package and install it in your plant.

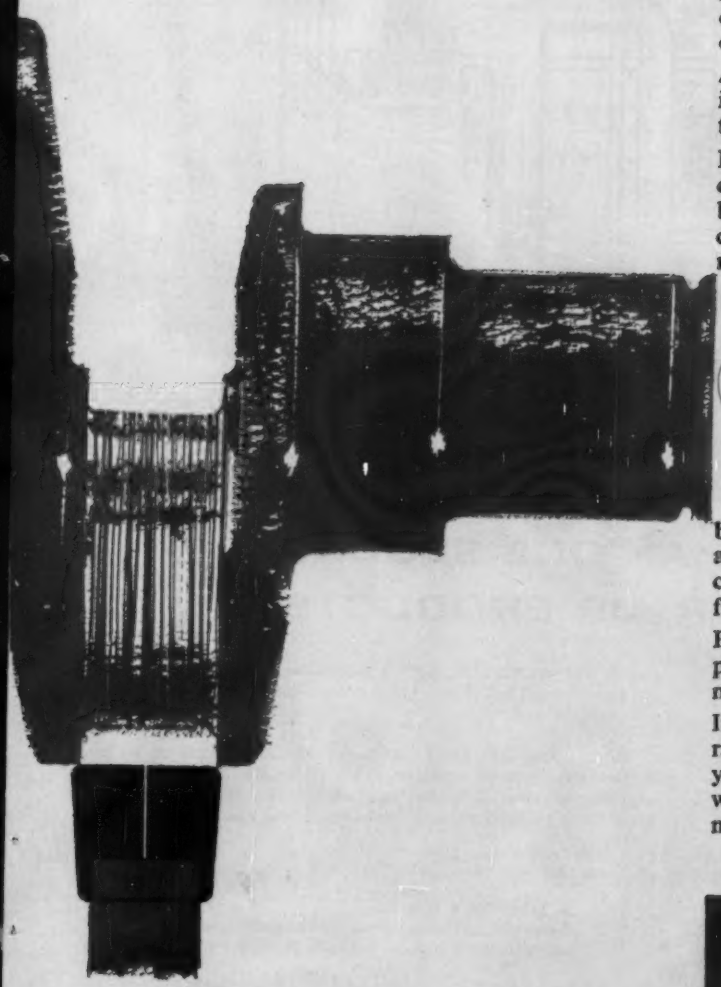


These packages are interchangeable so that any combination can be used to suit your needs. For example, you could have one base and three different tooling units. Additional packages or bases can be ordered at any time.

The LeBlond 6PC turns pin bearings, faces adjacent counterweight lobes, or both in a single machining cycle. It will handle forged or cast crankshafts with 2, 3, 4, 6, or 8 pins. It will accept cranks from 12″ to 41″ long with bearing diameters up to 5″.

Production rates will range from 10 to 40 per hour depending upon material, number of pins and webs to be machined, length of web cut, etc.

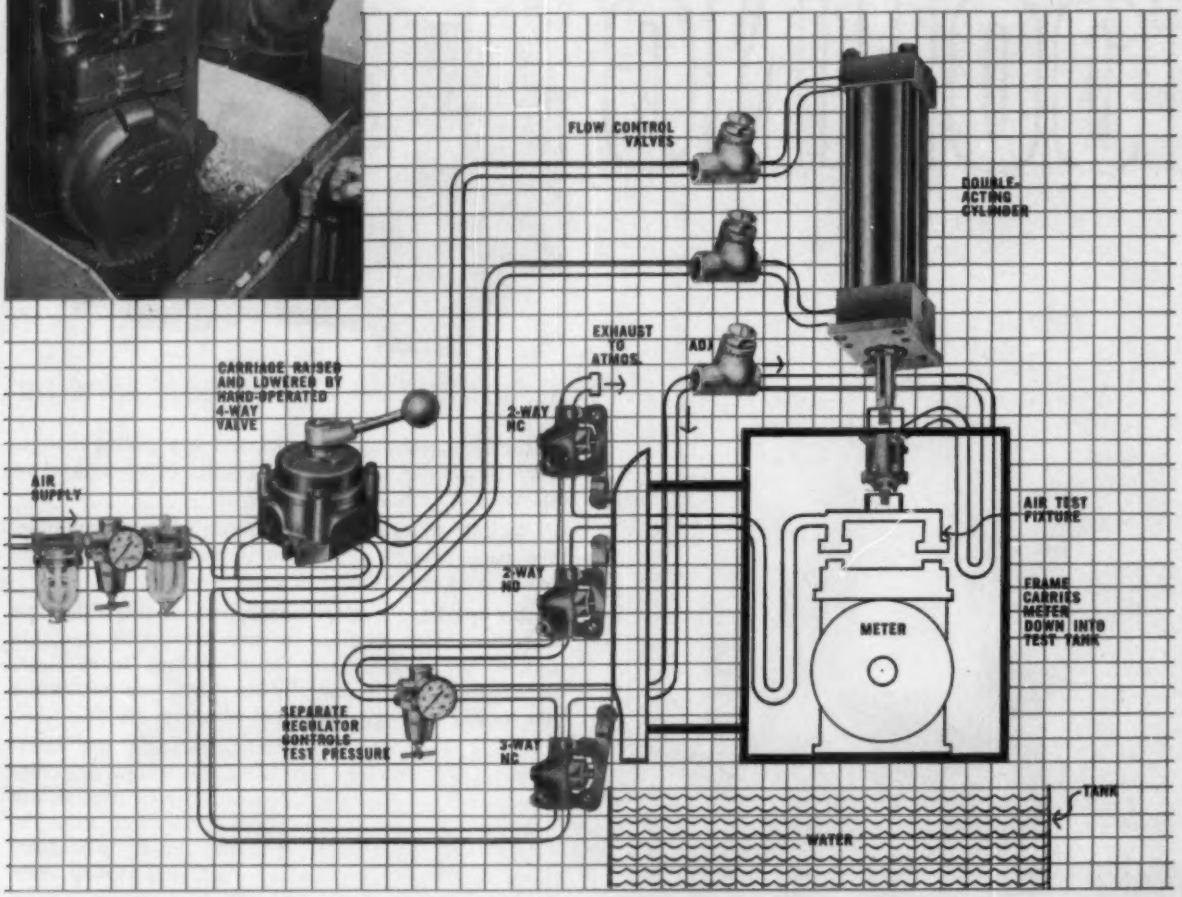
If flexibility is more important than maximum production rate in your shop, we would like to discuss the 6PC with you. Our latest catalog describes this new machine as well as our high production crankshaft lathes. Ask your nearby representative or write.



Ohio *World's largest builder of crankshaft lathes*

LeBLOND of Cincinnati

Here's how one company tests its products with air. This air circuit of Schrader Products at the Sprague Meter Company in Bridgeport, Connecticut, automatically clamps meter ports airtight, lowers meter into water, and fills it to test pressure. Operator looks for telltale bubbles from leaks, then presses lever to raise meter automatically. Says the Plant Manager: "This used to be a slow, arduous process. Now a meter's in the water, under pressure, in less than a second."



MANUFACTURER SETS UP CRITICAL TEST IN LESS THAN ONE SECOND— WITH SCHRADER AIR PRODUCTS

As products grow more complex and precise, many manufacturers are *simplifying* their operations—with air cylinders, valves, fittings and simple schematic planning. They're installing their own circuits, as this manufacturer did, or letting Schrader experts help. For example, Schrader Air Products can inspect, test, assemble, package—do work faster, more accurately—save effort and money.

Never forget air can make almost any motion human hands can—push, pull, hold, position, or move repetitively. And air doesn't get tired—has more powerful muscles. Maintenance? Almost nil.

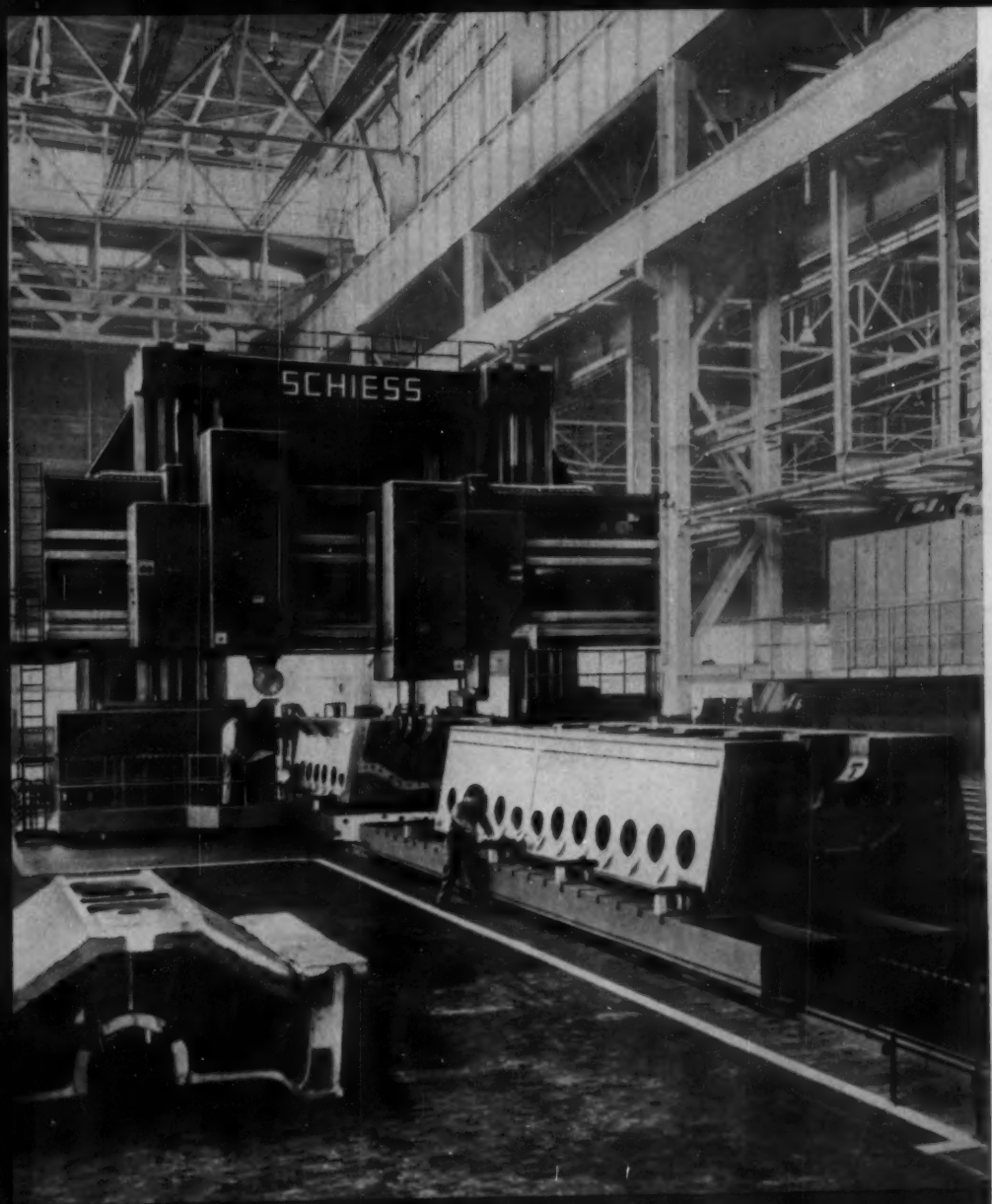
Take full advantage of your air power by automating with Schrader—the most complete line of Air Cylinders, Valves, and Accessories. Schrader engineers have experience and know how to help you cut your operating costs.

Select your automating equipment from the full Schrader line. Your Schrader distributor can help you pinpoint what you need. For more data, write:

Schrader®
a division of SCOVILL

A. SCHRADER'S SON
Division of Scovill Manufacturing Company, Incorporated
460 Vanderbilt Avenue, Brooklyn 38, N. Y.

QUALITY AIR CONTROL PRODUCTS



Maximum Performance and Accuracy

CIRCLE 423 READER SERVICE CARD

UNIVERSAL JIG AND FIXTURE COMPONENTS AND CLAMP ASSEMBLIES

Shown here are a few of more than a thousand different items in regular steel and stainless steel —the largest and most complete selection in the United States—now available from Universal Engineering Co. Write today for your copy of the complete, new catalog.

213

OTHER PRECISION-BUILT COST SAVING UNIVERSAL PRODUCTION TOOLS

Floating Chuck

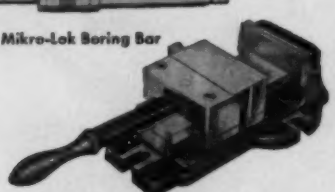
Standard Collet Chuck

Mikro-Lok Boring Bar

Boring Chuck

"Kwik-Switch" Tool Holder

Standard Drill Bushing

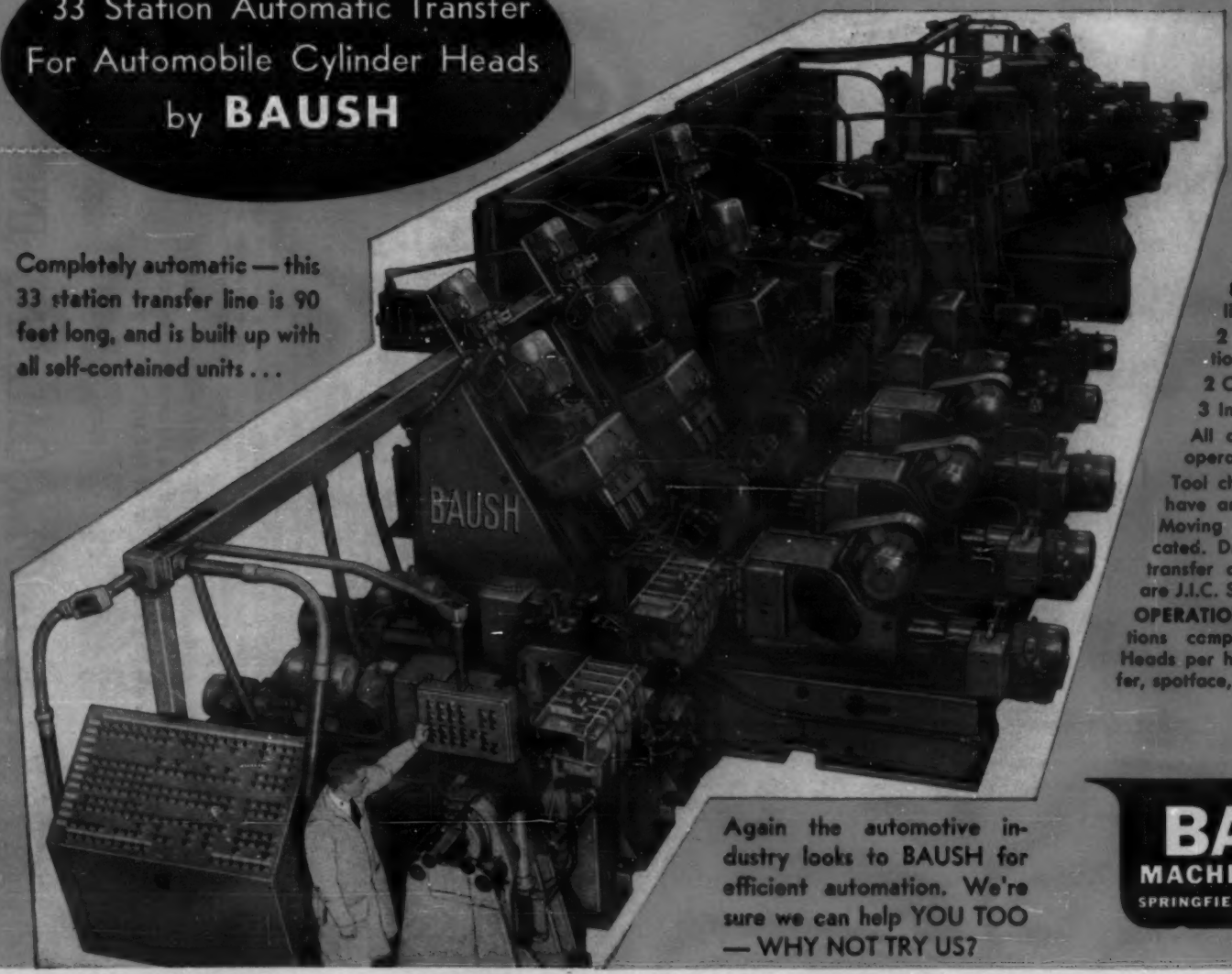


Wedge-Lock Production Vise

UNIVERSAL ENGINEERING COMPANY, FRANKENMUTH 1, MICHIGAN

33 Station Automatic Transfer
For Automobile Cylinder Heads
by **BAUSH**

15,600 operations per hour, with



Completely automatic — this 33 station transfer line is 90 feet long, and is built up with all self-contained units . . .

8 Horizontal "S" Mechanical Lead Screw Units

6 Vertical Angular "S" Mechanical Lead Screw Untis

4 Inverted Angular Mechanical Lead Screw Units

4 Horizontal "M" Mechanical Lead Screw Units

8 Vertical Angular Hydraulic Units

2 Probe and Blow-out Stations

2 Checking Units

3 Indexing Fixtures

All clamping and unclamping operations done hydraulically.

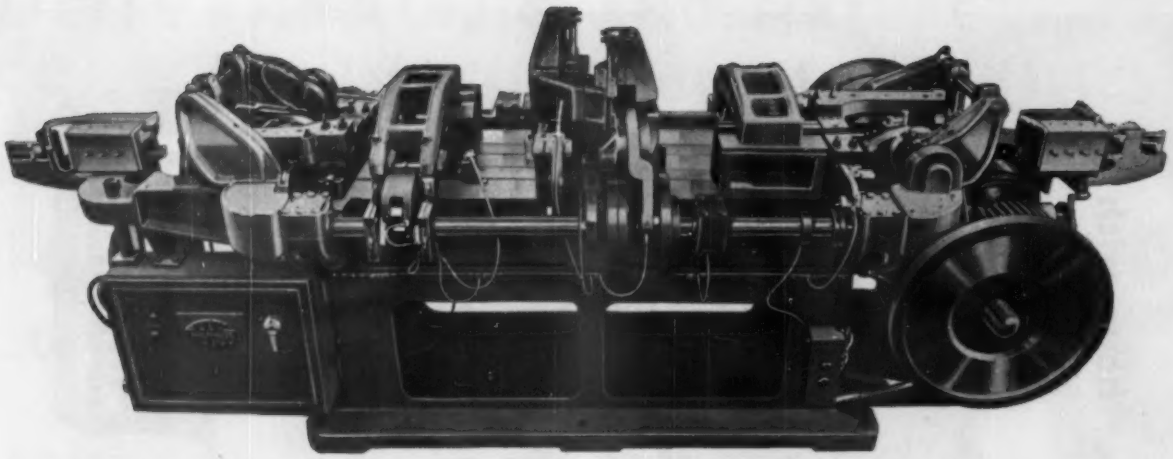
Tool changing and maintenance have ample room between units. Moving parts automatically lubricated. Detector system throughout transfer and all electrical controls are J.I.C. Standards.

OPERATIONS: 156 cutting operations completed on 100 Cylinder Heads per hour — drill, ream, chamfer, spotface, mill pads and end mill.

Again the automotive industry looks to BAUSH for efficient automation. We're sure we can help YOU TOO — WHY NOT TRY US?

BAUSH
MACHINE TOOL CO.
SPRINGFIELD 7, MASSACHUSETTS

CIRCLE 425 READER SERVICE CARD



U.S. DUPLEX MULTI-SLIDE®

SIMULTANEOUSLY

FEEDS AT BOTH ENDS & PRODUCES TWO OR MORE STAMPINGS & FORMS & ASSEMBLES

The new U. S. Duplex Multi-Slide is a double ended machine which more than doubles previous production potentials.

With the U. S. Duplex you can ■ Produce and assemble 2 different stampings from the same or dissimilar materials. ■ Produce and assemble 2 complementary stampings. ■ Produce stampings from one end, wire form from the other end and assemble. ■ Produce 2 stampings and assemble with hopper-fed, prefabricated parts. ■ Make 3 piece assemblies, feeding material from both ends — and from the top. ■ Make 2 or more identical or different stampings not requiring assembly — and of the same or different material. ■ And, can be operated as a conventional Multi-Slide by feeding material into one end only. **Standard U.S. Duplex Multi-Slide equipment includes a feed, stock straightener, check and ram action at each end and a common 4-slide forming position with double, vertical strippers at the center. Material up to 3" wide can be fed into both ends of machine simultaneously. Feed length is adjustable up to a maximum of 6" and can differ from each end of the machine. Investigate the economies a U.S. Duplex Multi-Slide can give you. A few of these are: elimination of secondary operations; savings in floor space; ease of inspection of finished assemblies; and fewer rejects . . . all through the versatility of the "Duplex".**

Write today for full information and specifications. Send us your samples or drawings today and let us show you.

MULTI-SLIDE

U.S. TOOL COMPANY, INC.

AMPERE (East Orange) NEW JERSEY

U. S. Multi-Slides® • U. S. Multi-Millers® • U. S. Automatic Press Room Equipment • U. S. Die Sets and Accessories

TWO BIG REASONS WHY HOLO-KROME SOCKET SCREWS ARE YOUR BEST BUY...

HOLO-KROME'S *Thermo-Forged SOCKET SCREWS

THE MOST DRAMATIC INNOVATION IN SOCKET SCREW MANUFACTURE IN 28 YEARS!

*U. S. Patents 2,901,583 and 2,953,794

HOLO-KROME'S FAMOUS SAME-DAY SERVICE

ON STANDARD CATALOG ITEMS

HOLO-KROME
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SOCKET SCREWS

SOLD ONLY THROUGH AUTHORIZED HOLO-KROME DISTRIBUTORS
THE HOLO-KROME SCREW CORPORATION • HARTFORD 10, CONN.

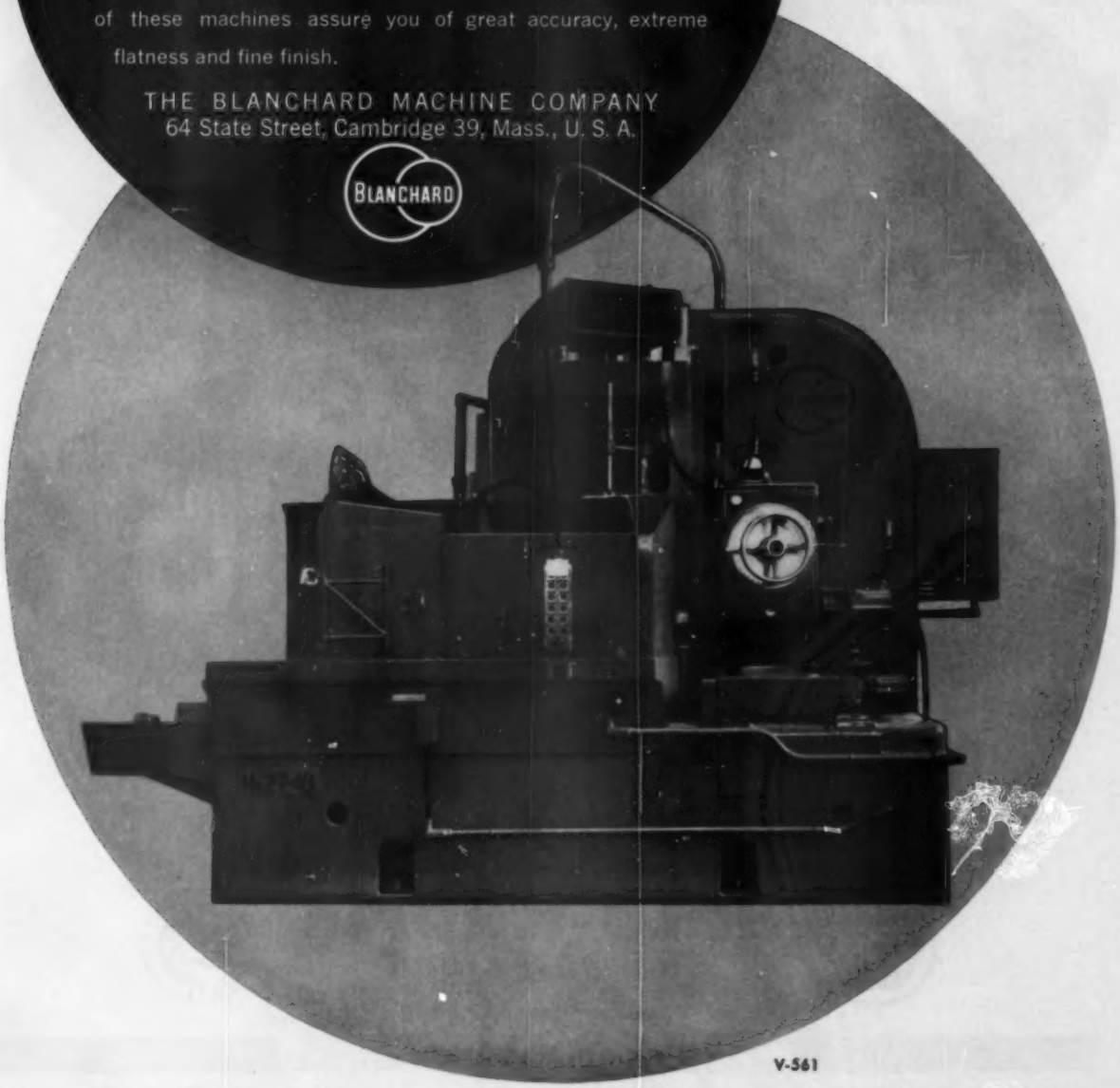
NEW

Blanchard
proudly introduces the No. 27-48
and No. 27-60 Blanchard Surface Grinders,

which offer new features and high-production capabilities that give you high-speed, precision grinding at lower-than-ever cost. These new Blanchards are of "dry base" design. All coolant and chips discharge from the grinder base. They are powered by a 60 or 75 HP main spindle motor. Coolant is directed both to the inside and outside of the grinding wheel. These features provide ample power, rigidity and coolant flow for heavy stock removal on a large variety of work pieces. The advanced design and careful construction of these machines assure you of great accuracy, extreme flatness and fine finish.

THE BLANCHARD MACHINE COMPANY
64 State Street, Cambridge 39, Mass., U. S. A.

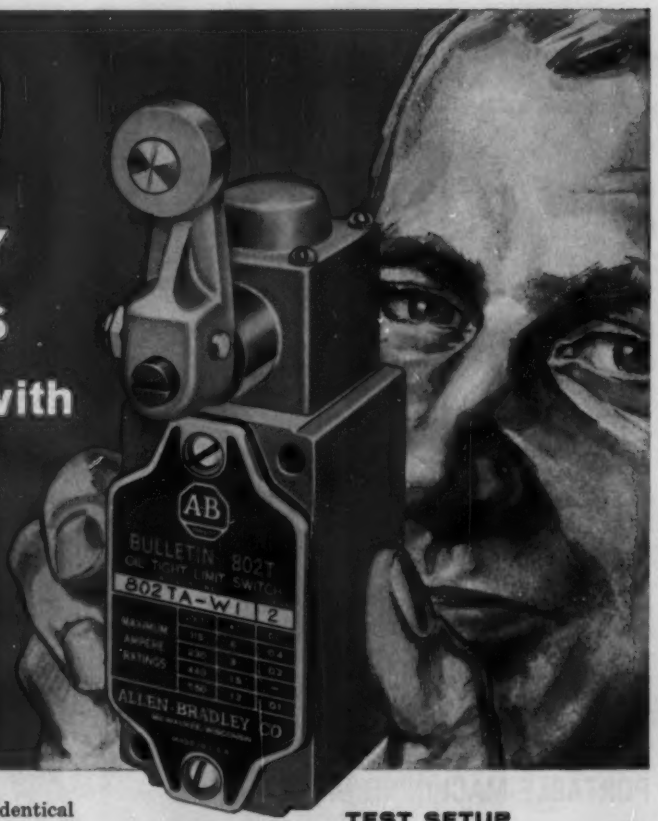
BLANCHARD



V-561

Only ALLEN-BRADLEY LIMIT SWITCHES FINISHED TEST with *NO FAILURES!*

...and remained good for many more millions of trouble free operations

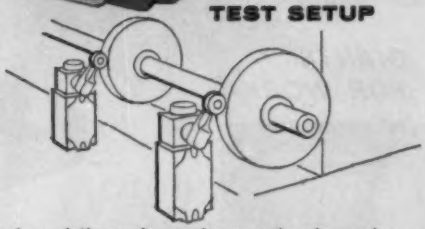


Recently, a large user of limit switches selected two identical units from each of five leading manufacturers and subjected them to the same accelerated life test. When the test was stopped after many, many millions of operations, only Allen-Bradley Bulletin 802T oiltight limit switches were left *with no failures!* Also, a careful inspection of these two Bulletin 802T limit switches suggested that they were still good for *many more millions* of operations.

The Allen-Bradley "built-in" quality is the reason for such unmatched performance. With switch bodies and operating heads positively sealed against oil and dirt, A-B Bulletin 802T limit switches are free from contact fouling and sluggish operation. The precision switch mechanism has a positive snap action—it is impossible for vibration to cause contact chatter. The double break, silver contacts never need servicing.

Insist on Allen-Bradley Bulletin 802T oiltight limit switches—they will *always* provide you with the long, trouble free life that is so important to continuous production. Send for details on the complete A-B limit switch line.

TEST SETUP



Purchased through regular supply channels . . .

and tested under identical conditions, insuring an impartial evaluation of performance. Of the ten limit switches tested (two each of five different makes), only three were operating when the test was stopped. Two were A-B Bulletin 802T switches and one of another make, of which the second unit had failed early in the test. On this accelerated life test, one unit switched 1.0 ma at 115 v dc while the other unit switched 10 ma at 115 v dc.

ALLEN-BRADLEY

Member of NEMA

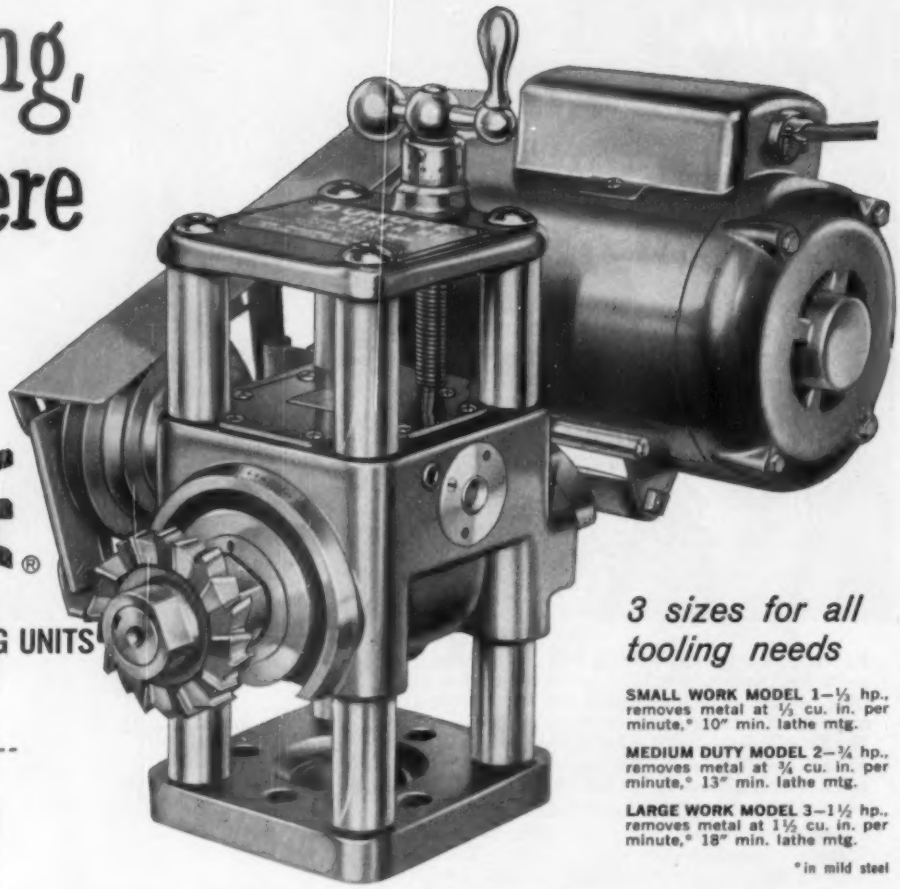
QUALITY MOTOR CONTROL

machine anything, anywhere

with

DUMORE®
VERSA-MIL
PORTABLE MACHINING UNITS

GIANTS FOR WORK--
yet move easily from job to job



3 sizes for all tooling needs

SMALL WORK MODEL 1—⅓ hp., removes metal at ⅓ cu. in. per minute,* 10" min. lathe mtg.

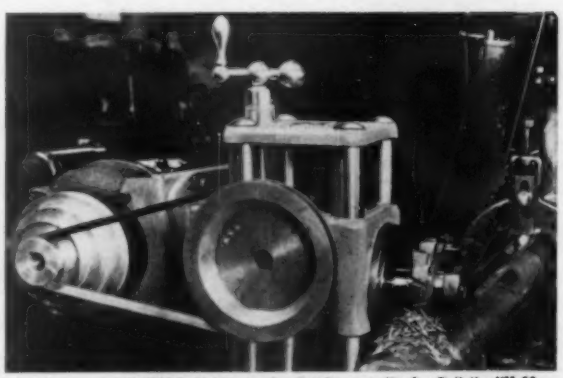
MEDIUM DUTY MODEL 2—¾ hp., removes metal at ¾ cu. in. per minute,* 13" min. lathe mtg.

LARGE WORK MODEL 3—1½ hp., removes metal at 1½ cu. in. per minute,* 18" min. lathe mtg.

*in mild steel

***MILL • BORE • SHAPE • SLOT • GRIND • DRILL** at lower cost*

Compact, rigid, portable units in three sizes. Perform in any position. Built-in power and feeds. Use independently or attach to machine tools for secondary operations. Save handling, moving, set-up and down-time. Also machine in-place parts too big for standard tools. One unit often pays for itself on one job. Provide close tolerance quality at **profitable** metal removal rates. Give **you** the advantage of machining where it is most economical!



Ask Your Local DUMORE Distributor for Details or write for Bulletin VM-60.

YOU CAN DO MORE WITH **DUMORE®** ALL-PURPOSE, PRECISION METALWORKING TOOLS

Versa Mil • Drill-N-Tap Units • Drilling Units
Feed Tables • Drill Heads • Micro-Drills
Drill Grinders • Tool Post Grinders • Hand Grinders
Flex-Shaft Tools • Precision Spindles and Accessories

THE DUMORE COMPANY 1329 Seventeenth Street, Racine, Wisconsin

let's talk CAPACITY

FOR A SINGLE MACHINE OR A COMPLETE LINE

CAPACITY, what does this represent in terms of dollars to a prospective buyer of metal cutting machines.

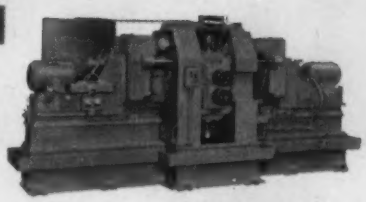
We at **MICHIGAN** feel that manufacturing **CAPACITY** is an important asset and most beneficial time saving aid available. We constantly strive to improve our manufacturing and assembly methods, this in turn increases our **CAPACITY.** The ability to manufacture machines in less time, results in a low product cost to the customer.

- Modern Building.
- Excellent plant facilities.
- Complete engineering.
- National sales staff.
- Blueprint and duplicating departments.
- Manufacturing facilities to machine every detail in all of our many components.
- **MICHIGAN** designs and fabricates electrical, hydraulic and lubrication installations.

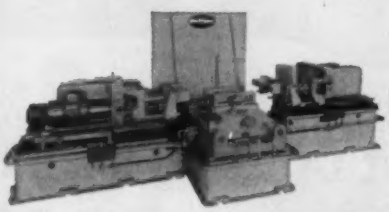
All this represents **CAPACITY.**

MICHIGAN'S CAPACITY pays off in savings to our customers. If you're looking for a special metal cutting machine of any kind, remember **MICHIGAN**—we specialize in dependable delivery, low product cost and excellent service. Send us your inquiries, we will be pleased to serve you promptly.

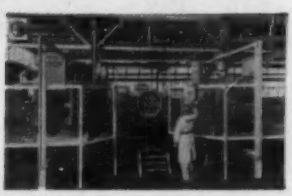
DIAL



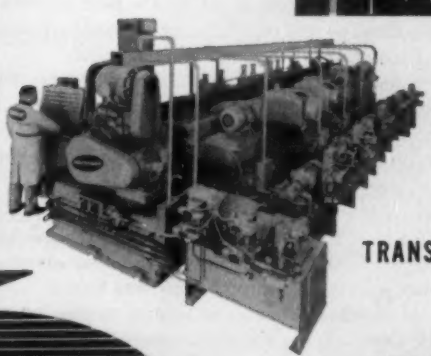
TRUNNION



SHUTTLE



SPECIAL



TRANSFER

TRANSFER
DIAL EQUIPMENT
TRUNNION
SHUTTLE
GUN DRILLING
TAPE CONTROL
DRILL HEADS
FIXTURES

Michigan

SPECIAL MACHINE CO.

11449 TIMKEN AVE. • WARREN, MICHIGAN

DRILLING
REAMING
TAPPING
SPOT FACING
CHAMFERING
COUNTER BORING
BORING
MILLING

LINDE 99.9% Pure ALUMINA ABRASIVES

'BULOVA' WATCH PINIONS (sample shown magnified 100x) now have important surfaces polished to a high precision finish with LINDE alumina abrasives. Actual size is at right →

Permit Critical Finishing of ALL Modern Metals with ONE BASIC MATERIAL

No longer need the minuteness of a metal part, or its shape, or its type of metal interfere with the quality of its finish.

All-new LINDE abrasive powders—of 99.9% pure alumina—now permit precision finishing and polishing, as well as sharpening and honing of many metal parts—with *one basic material.*

Depending upon usage, LINDE alumina powders can be used dry, mixed with water or other vehicles to make a thin slurry or heavy paste, or compounded with waxes in convenient stick form. They are uniform in size, thus eliminating levigation in finishing operations. And they are resistant to common acids.

Only two grades of these low-cost, fast-cutting, high-purity white powders are required: LINDE A (*alpha alumina*) for quicker cutting and an unsmeared finish; LINDE B (*gamma alumina*) for somewhat slower cutting but an extremely fine finish.

For details on alumina abrasives as applied to your production problems, write Dept. AM-121, Linde Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, New York. *In Canada:* Union Carbide Canada Limited, Linde Gases Division, Toronto 12.

PHYSICAL PROPERTIES

	Type A-5175	Type B-5125
Chemical Formula	Al_2O_3(Alpha)	Al_2O_3(Gamma)
Crystal System	Hexagonal	Cubic
Hardness, Mohs'	9	8
Particle Size approximate (microns)	0.3*	<0.1
Apparent Density (g/c.c.)	0.3-0.6	0.2-0.5
Melting Point	2050° C.	Transforms to Alpha form at high temperatures

*Type C-5250 also available in 1.0 microns (approximate) particle size.

SUGGESTED USES

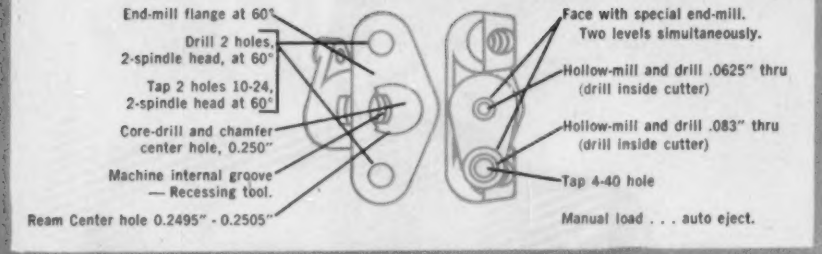
CHEMICAL: Catalyst Carrier • **ELECTRONICS:** Semiconductor Polishing • **JEWELRY:** Gem Stone and Crystal Polishing; Silver Polishing • **LIGHTING:** Phosphor Preparation • **CERAMICS:** Pure Oxide Ceramics • **METAL FABRICATION:** Finishing of Metal Parts; Knife Sharpening; Microtome Knife Sharpening; Razor Blade Sharpening • **METALLURGY:** Metallographic Polishing • **OPTICAL:** Glass Polishing

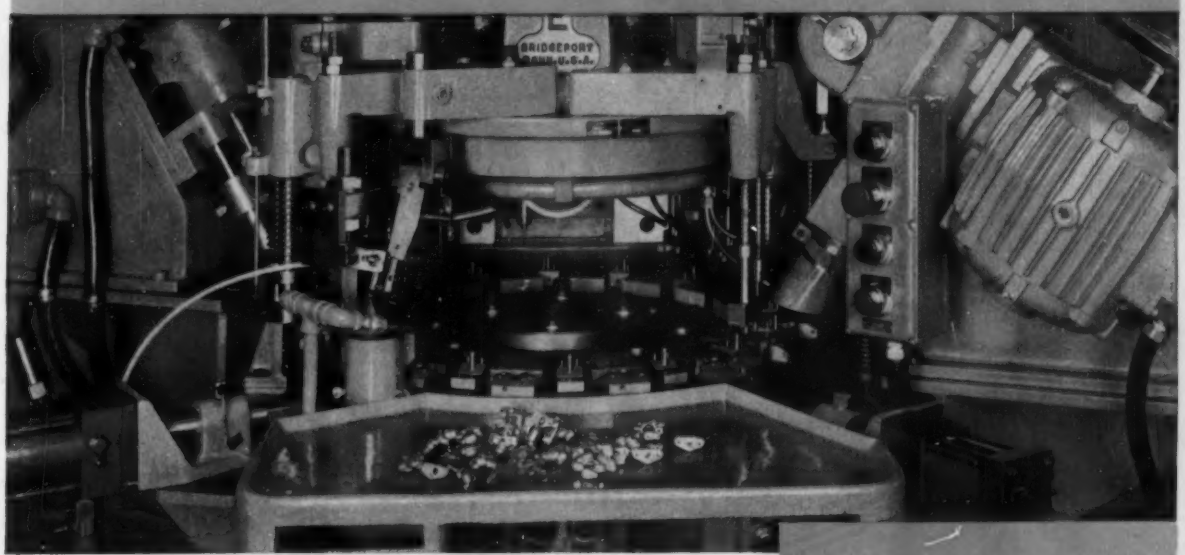
LINDE COMPANY
DIVISION OF UNION CARBIDE CORPORATION

UNION CARBIDE

LINDE and UNION CARBIDE are registered trade-marks of Union Carbide Corporation

Bodine CASE HISTORY NUMBER 52


First Cycle
End-mill flange at 60°
Drill 2 holes, 2-spindle head, at 60°
Tap 2 holes 10-24, 2-spindle head at 60°
Core-drill and chamfer center hole, 0.250"
Machine internal groove — Recessing tool.
Ream Center hole 0.2495" - 0.2505"
Second Cycle
Face with special end-mill. Two levels simultaneously.
Hollow-mill and drill .0625" thru (drill inside cutter)
Hollow-mill and drill .083" thru (drill inside cutter)
Tap 4-40 hole
Manual load . . . auto eject.



A HALF-PRICE BARGAIN
in streamlined production!

These small thermostat valve bodies are components of the automatic transmission units for new compact cars.

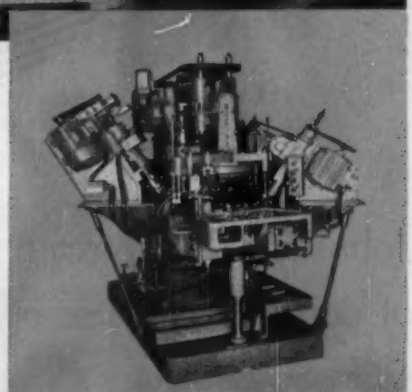
One of the world's largest makers of auto transmissions ordered the Bodine Basic Unit, equipped and tooled to perform 15 separate operations on the part in two consecutive, simultaneous work cycles . . . 8 operations on the first and 7 on the second, as shown in the above sketches.

For this job, Bodine methods offered a number of important advantages not available in alternative proposals . . . including mechanical actuation, extremely flexible and versatile tooling, dependably close adherence to tolerances, compact design and low initial cost.

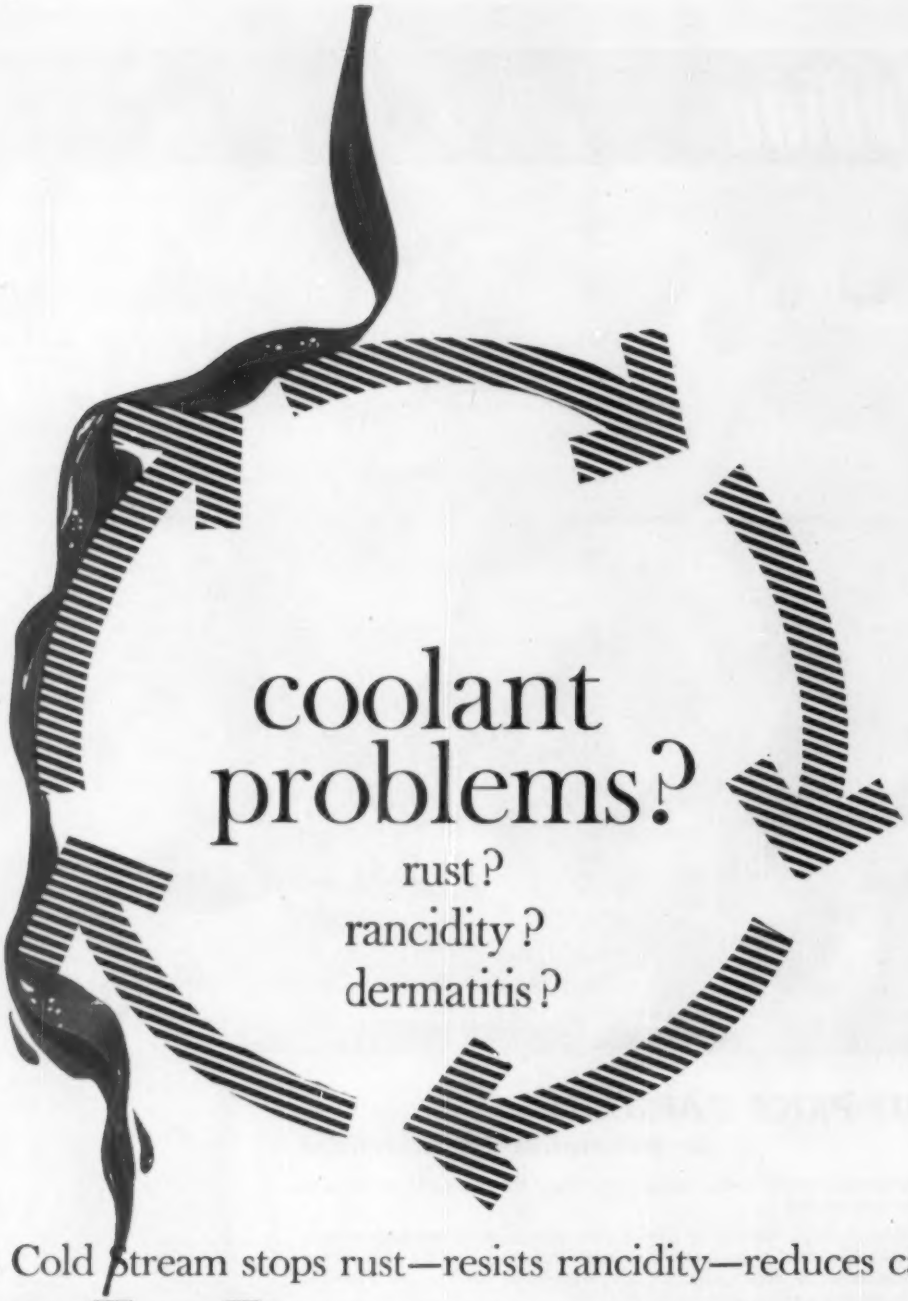
The Bodine 48-30 machine, in fact, is about *one quarter* the size of typical hydraulic or pneumatically controlled units. It was placed on the customer's production line at approximately *one half* the cost of such units. Being controlled from a single main shaft and cam system, operating adjustments are more easily made and maintenance is at a minimum. Famous Bodine ruggedness assures long-run economy.

There are very few jobs in this general category that cannot be handled to unusual advantage on such Bodine basic machines with our standardized tooling methods. Hence, before considering costly "specials" it will surely pay you to consult us. Send your prints or samples for study . . . without obligation . . . write Dept. AM-12 today.

Production: 500 pieces per 50-minute hour with machine running at 10 strokes per minute.



THE Bodine CORPORATION
BRIDGEPORT 5, CONNECTICUT
AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING AND SCREW INSERTING MACHINES



coolant problems?

rust?
rancidity?
dermatitis?

Johnson's Cold Stream stops rust—resists rancidity—reduces causes of dermatitis. These problems start when your coolant gets dirty. Cold Stream stays clean week after week—even on cast iron. Cold Stream gives longest tool life. Finest finishes. Highest speeds and feeds. Best dimensional control. Cold Stream gives you all the performance you pay for. **JOHNSON'S WAX**

cold stream

For information, see your local Johnson industrial distributor.

"Cold Stream" and "Johnson's" are trademarks of S. C. Johnson & Son, Inc., Racine, Wis.

These Henry & Wrights Do What 5 to 10 Conventional Presses Do- *More Quickly*

Over 3000 Henry & Wright Dieing Machines in service today, attest to the popularity of one of our earliest forms of automation. They were born to the mass production industry almost before it started. Every model employs the same basic design principles. A low center of gravity with all driving elements below the die bed assures stability for high speed operation. Precision alignment is provided by the long guiding surfaces; a pulling stroke rather than a pushing force gives better control; angular thrust of crankshaft is absorbed by lower crosshead instead of by slide or punch. These and many other features assure maximum die life, at higher speeds, with more profit for you.

These high production units can replace the work of several conventional presses cutting labor costs proportionately. Modern progressive dies can produce virtually any shape, with any material, simpler and faster. Let H-P-M engineers adapt Henry & Wrights to your next mass production problem. Take advantage of less operating cost, reduced amount of floor space required, greater production output.

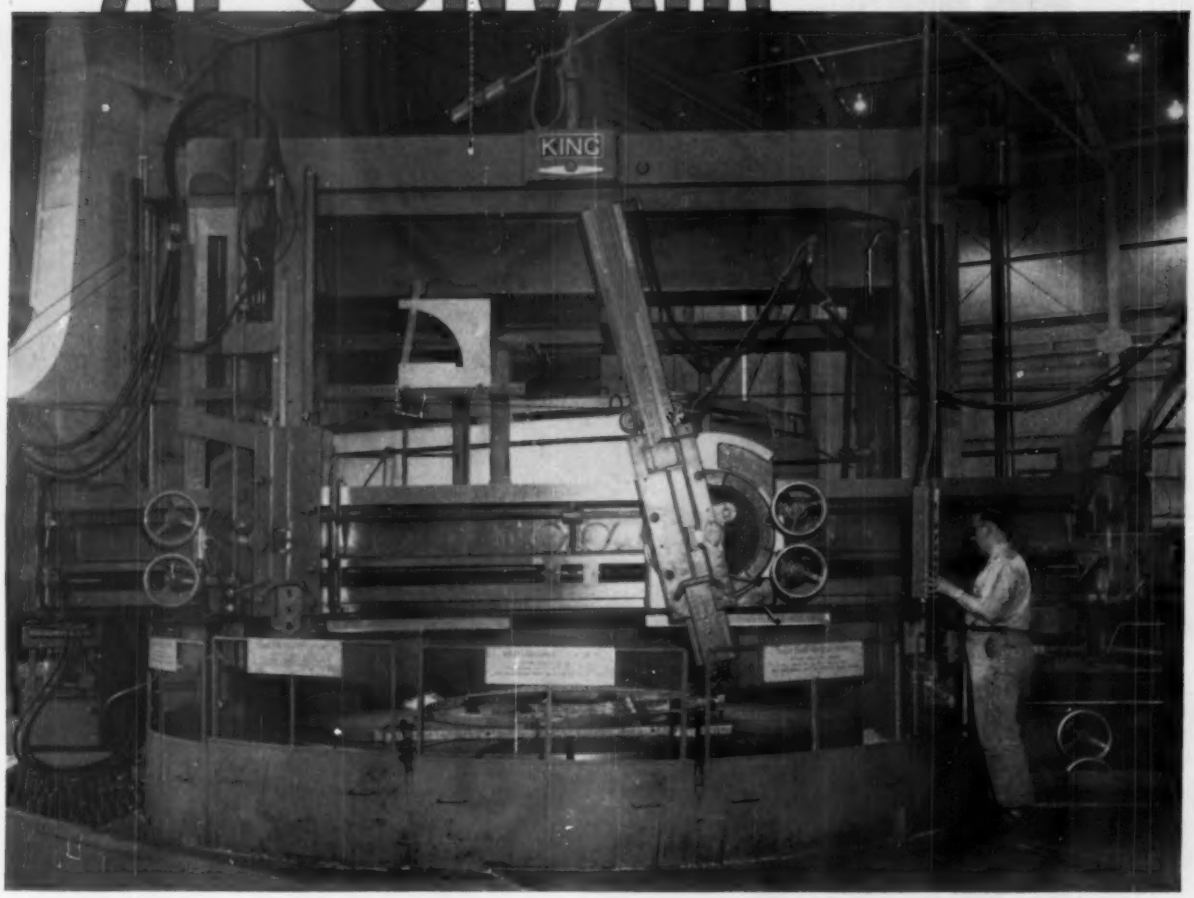
THE HYDRAULIC PRESS MANUFACTURING COMPANY

A Division of Koehring Company • Mount Gilead, Ohio, U.S.A.

HPM

H40

AT CONVAIR— SAN DIEGO



Convair's Plant No. 1 Tooling Department uses this specially designed 168" KING® to shape drop hammer dies, plastic patterns used for production mock-ups, and plastic tools. They report, "Production of such tooling in sizes and tolerances required was not possible with previously available machines."

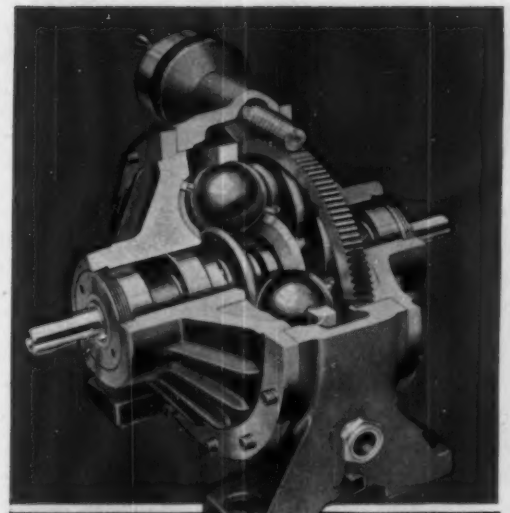
Versatility is just *one* virtue of this big "customized" KING.

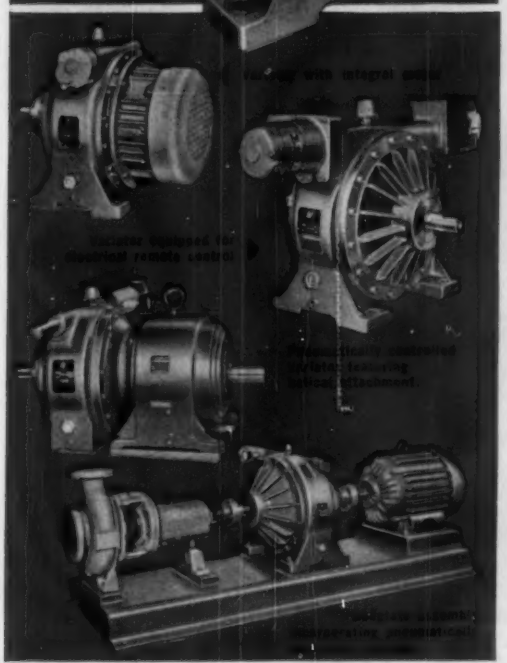
It's Fast, Accurate and Dependable, too!

KING Vertical Boring and Turning Machines

ELMES Hydraulic Presses and Equipment

American Steel Foundries / ELMES-KING Division, 1161 Tennessee Avenue, Cincinnati 29, Ohio





for accurate, dependable, infinitely variable speed control, specify...

CLEVELAND SPEED VARIATOR

Cleveland Speed Variators are simple in operation . . . built for long life. Eighteen models—including a new motorized unit—range from fractional to 16 hp at 1750 input RPM. They all accurately provide dependable, infinitely variable speed control over a full 9:1 range—from ⅓ to 3 times input speed. Instant smooth change of output speed can be adjusted by either manual, automatic or remote control. Precise adjustments are always made with accurate adherence to settings.

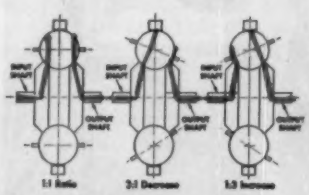
Exclusive Variator advantages:

- An extremely compact unit with input and output shafts in line and rotating in the same direction.
- Almost any input speed up to 1800 RPM can be used—either clockwise or counterclockwise rotation.
- Rated for constant horsepower output over a 9:1 or 6:1 range; or for constant output torque over a 6:1 range.
- Speeds infinitely variable over entire range of adjustment.
- No slippage—positive torque response mechanism adjusts in direct proportion to the loads encountered.
- Long life and minimum maintenance due to absence of belts or complicated linkages.
- Ample bearing support for overhung pulleys on both input and output shafts.

Write today for free Bulletins and Data Sheets shown at left. They contain detailed description, photographs, sectional drawings, rating tables and specifications for the versatile Variator.

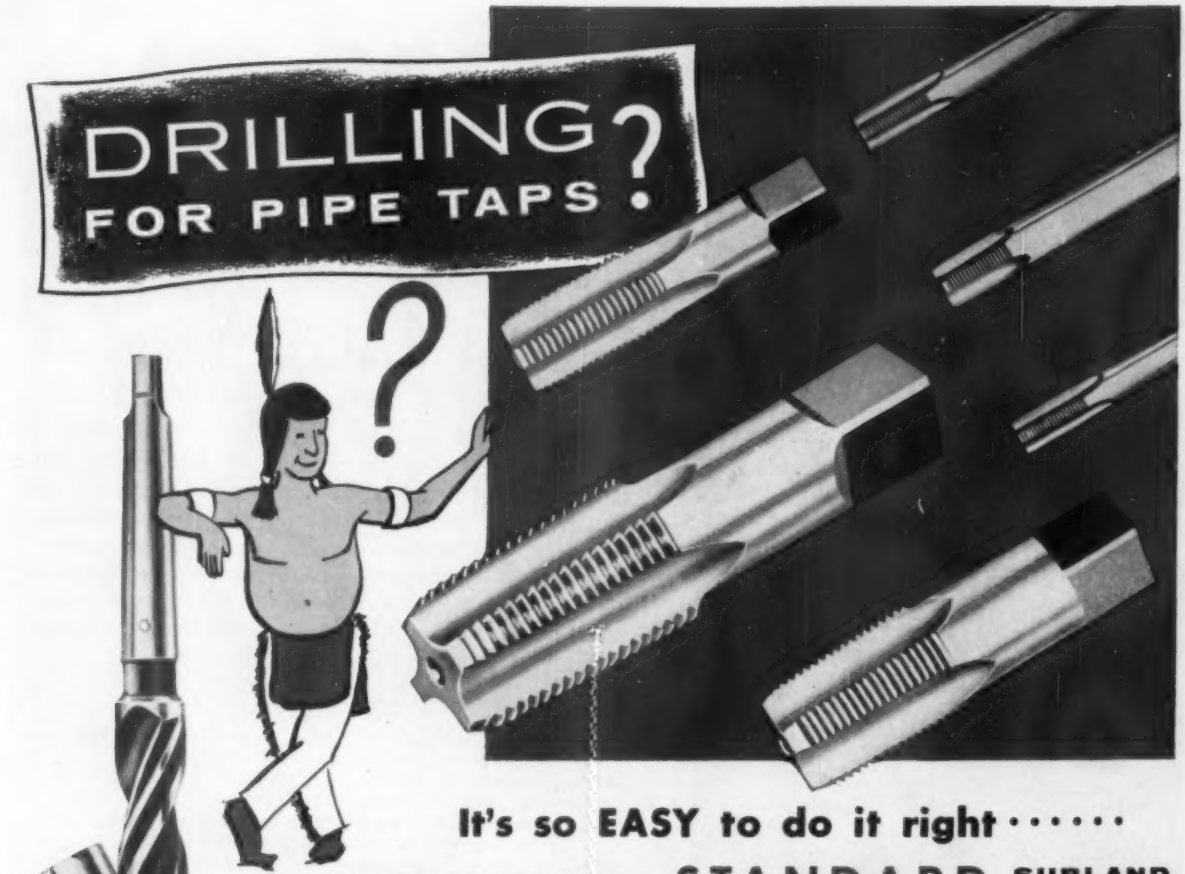
Cleveland Worm & Gear Division
Eaton Manufacturing Company
3254 East 80th Street • Cleveland 4, Ohio

Power is transmitted from input shaft to output shaft — rotating in the same direction — through alloy steel driving balls which are in pressure contact with the drive discs. Relative shaft speeds are adjusted by changing position of axles on which the balls rotate.



CLEVELAND SPEED VARIATOR

DRILLING? FOR PIPE TAPS?



It's so EASY to do it right · · · · · ·

with MOHAWK STANDARD SUBLAND DRILLS

Fast and economical, too! With a Mohawk Standard Drill-Chamfer subland, you drill and chamfer simultaneously . . . all in one operation.

Think of it! You do the job *right* and save the extra tools, the jig and fixture movement, working time and eliminate tap breakage as well as scrapped parts. All this . . . plus the bonus fact that *one* Mohawk "standard" will outwork and outlast dozens of ordinary drills because Sublands have cutting flutes for each diameter, they can be resharpened (in your plant) without losing concentricity.

There's no excuse...Mohawk "standards" are available in all sizes, types or combinations in both factory and local stocks. You can start to save the Mohawk way—today!

Ready . . . and Waiting
. . . your new catalog of Mohawk "Standards" is awaiting your request.

MOHAWK STANDARD SUBLANDS are stocked in these three basic types in three step lengths and three shank styles. *All practical sizes and combinations.*

Let Mohawk prove to you that a Standard Subland is the most efficient and economical tool to use for multiple drilling operations. Check your maintenance costs along with the number of pieces per grind. Mohawk will guarantee you a provable, substantial saving.

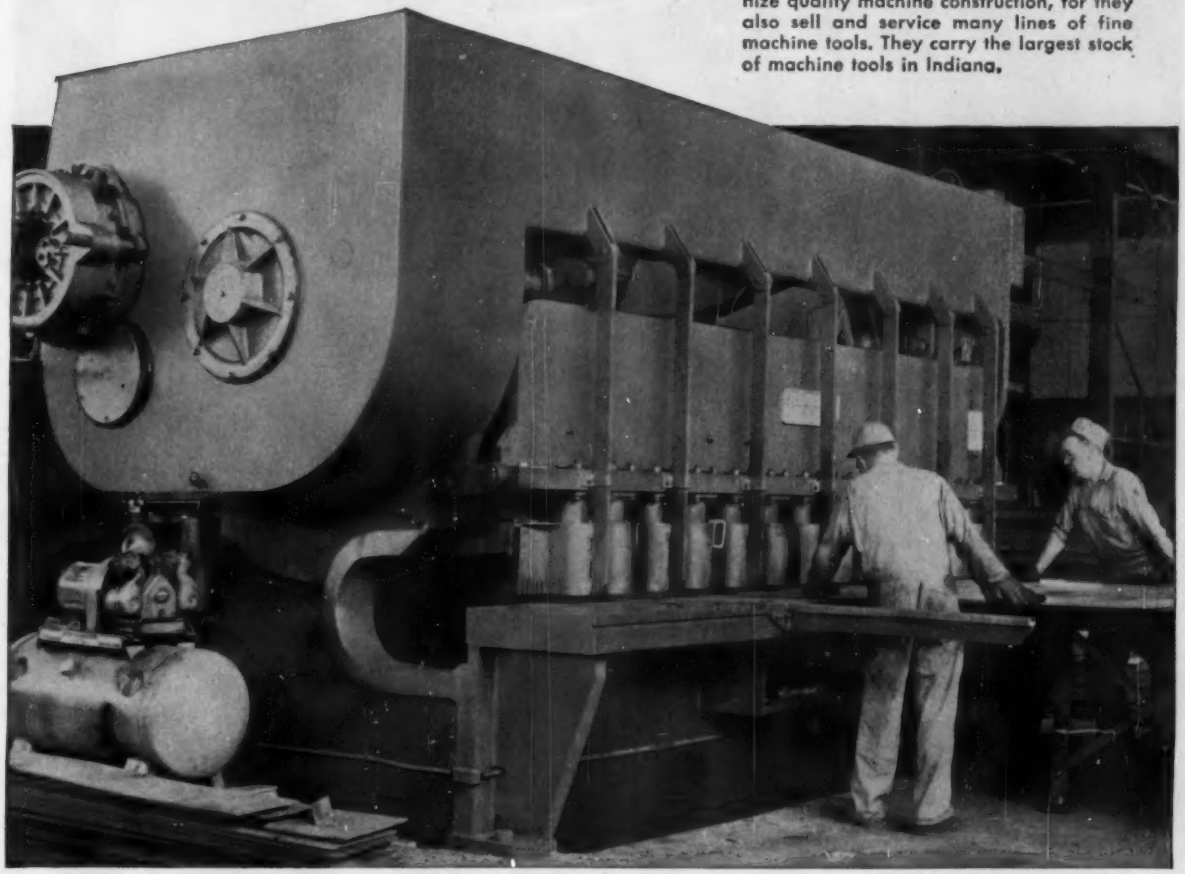
world's largest producer of Subland Drills

Mohawk
TOOLS, Inc.
Montpelier, Ohio

STEELWELD SHEAR ENABLES STEEL WAREHOUSE TO PROVIDE DELUXE SERVICE

Indianapolis Supplier Cuts Plates To Suit Customers' Needs EXACTLY

This Steelweld Shear is much appreciated at the Indianapolis Machinery Co., Inc. And they should be in a position to recognize quality machine construction, for they also sell and service many lines of fine machine tools. They carry the largest stock of machine tools in Indiana.



WITH a Steelweld Pivoted-Blade Shear that has been operated continuously in its steel warehouse since 1953, the Indianapolis Machinery Co., Inc., Indianapolis, furnishes metal cut to exactly meet its customers' requirements.

This usually means thicknesses from 3/16 to ¾ inch, widths varying from a few inches to 12 feet and lengths to the maximum available from the mills. The metal may be mild steel, stainless or any of a number of special alloys. Whatever the metal or thickness, the cuts are straight and accurate with negligible burr, because the knife clearance is always adjusted to produce the best results.

Some orders call for strips of type 304 stainless, 5/16 and ⅜ inch thick by 1¾ and 2¾ inch wide. Others call for hard abrasive-resisting steel in strips ⅜ by 2 and 2¼ inches. Because of the shear's very low knife rake angle, such items are made with extremely little twist, camber and bow.

The air-operated clutch and brake have proven phenomenal by customary shear standards. Despite the tens of thousands of times the clutch and brake have opened and closed in making as many cuts over the years, the original linings are still in use. The action continues snappy and positive. The machine has its own air compressor mounted on one end.

Considering the large volume of shearing work done, the knife wear has been long and satisfactory. Knife grindings have been at least a year or more apart. This is attributed to not only the quality of the knives, but to the low rake at which they operate and also the correct knife clearance used for all cutting.

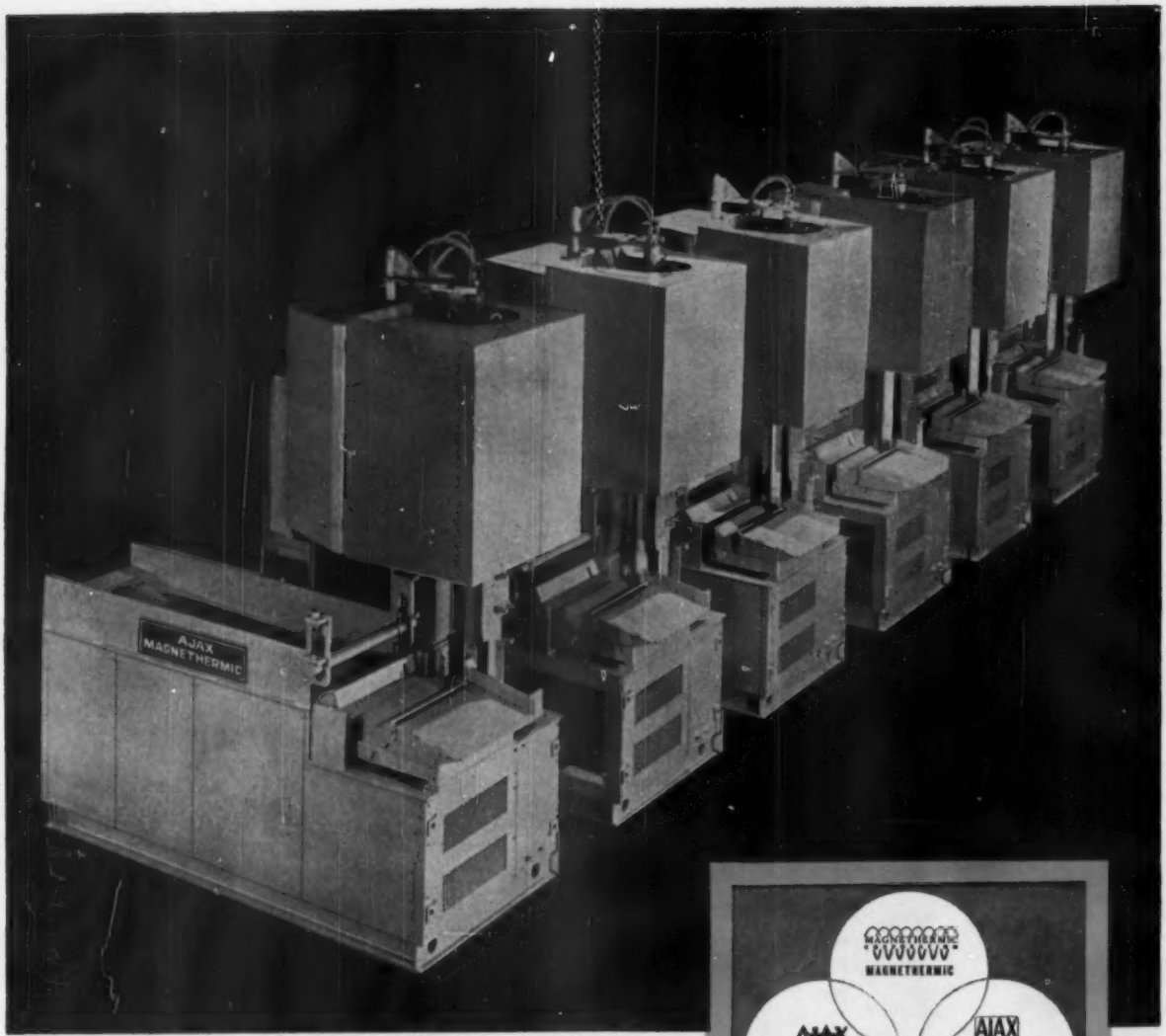
Write for free copy of catalog No. 2011

STEELWELD

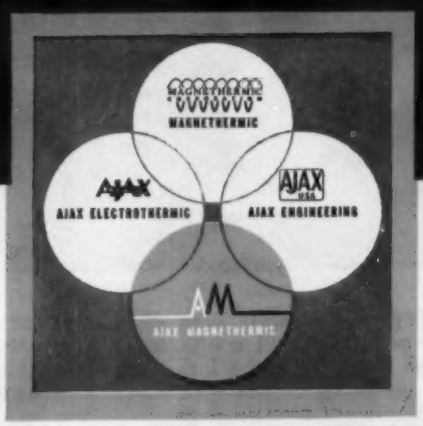
PIVOTED BLADE **SHEARS**

Steelweld Machinery includes: Shears and Press Brakes, One-, Two- and Four-Point Straight-Side Presses, Speed-Draw Presses.

STEELWELD MACHINERY DIVISION, THE CLEVELAND CRANE & ENGINEERING COMPANY • 1462 E. 282nd ST. • WICKLIFFE, OHIO



These six 400 KW vertical Billet Heaters heat stainless steel billets—5" —10" dia. x 28" long, to 2300° F at the rate of 12,000 lbs. per hour.



WATCH AM

FOR THE NEW IDEAS IN HEATING AND MELTING BY INDUCTION

Vertical Steel Billet Heaters, one of many products of AM, for the heating or melting of metals by Induction.

"induction heating is our only business"

AJAX Magnethermic CORPORATION

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YOUNGSTOWN DIVISION
3990 Simon Road
Youngstown 1, Ohio

TWO TOOLS

designed especially to meet the needs arising in small parts assembly and inspection

Here are two tools designed especially for small parts handling. Each meets different requirements. One may solve a major problem in your operations. See which will help you do a better job.

ILLUMINATED RIM-LITE MAGNIFIER

Equipped with a 5-inch precision-ground, distortion-free optical glass magnifier with a power of 3 diopters. Magnifier is mounted in circular, fully shielded lamp housing. Accepts standard C.F. (circular fluorescent) lamps, and delivers cool, shadowless, even illumination. Optional, auxiliary 2-diopter lens increases total power to 5 diopters by simply placing it onto standard lens.

Lens-light assembly may be raised or lowered on tubular upright, and locked at any desired position between 4" and 10" above the platform base. It can also be swung from side to side, or tilted. It can, in fact, be secured in any position suitable for assembly, soldering, welding and other similar operations.

Base is a solid-metal casting with accurately machined platform upon which parts or holding fixtures are placed. A felt pad is also supplied for jewelry or other delicate specimens.

NIKON SM2 STEREO MICROSCOPE

A rugged, precision-built instrument for 3-dimensional examination of small parts at magnifications ranging from 14 to 60 times. Image is erect and unreversed.

Use of high quality, hard-coated Nikkor optics and precise collimation permits continuous use without eyestrain. The SM2 has both coarse and fine focusing controls. The eyepieces are equipped with eyecups, and are inclined at an angle of 60° from the vertical. Inter-pupillary distance is adjustable from 55 to 75mm.

The basic SM2 consists of one pair of fixed objective lenses and one set of paired eyepieces for one magnification of your choice. Two additional sets of paired eyepieces, and two auxiliary objective attachments are available for eight additional magnifications. For complete details and list of accessories, write Dept. 'AM-12.

NIKON INCORPORATED, 111 FIFTH AVENUE, NEW YORK 3, N. Y. • SOLE U. S. DISTRIBUTORS

THE MAN & THE DRIVES

FROM WESTINGHOUSE

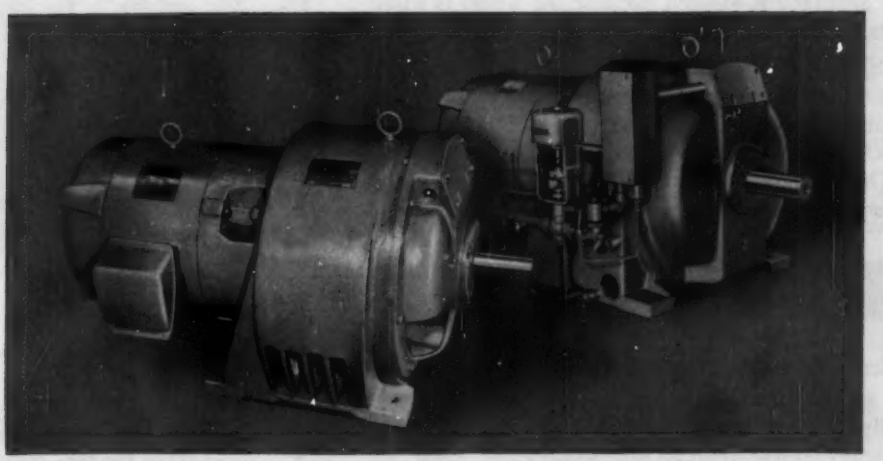
Mr. Westinghouse and MagnaFlow Drives Bring Simple Solution to Speed Control Problems, Save Money and Space, Too!

Westinghouse MagnaFlow* electromagnetic drives—air or liquid cooled—provide infinitely adjustable speeds from standstill to top speed with regulation guaranteed at ±2% of top speed over a 17-to-1 speed range (even closer regulation when desired). Control is smooth and stepless.

These compact drives, having a minimum number of parts, are built for rough, trouble-free service. The unique electromagnetic coupling maintains adjustable output speed without the use of pulleys, belts, brushes, commutators, slip rings or rotating windings. A rugged Life-Line® "A" motor supplies reliable a-c drive power. No power converting equipment needed—only a small, static exciter and an operator's control station. Initial cost is low; installation—easy and inexpensive.

Your Man from Westinghouse is ready now to help you apply MagnaFlow drives . . . and any other drives you may need. Call him . . . or write for a copy of Westinghouse MagnaFlow Electromagnetic Drives (B-7875), Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. You can be sure . . . if it's Westinghouse. J-22162

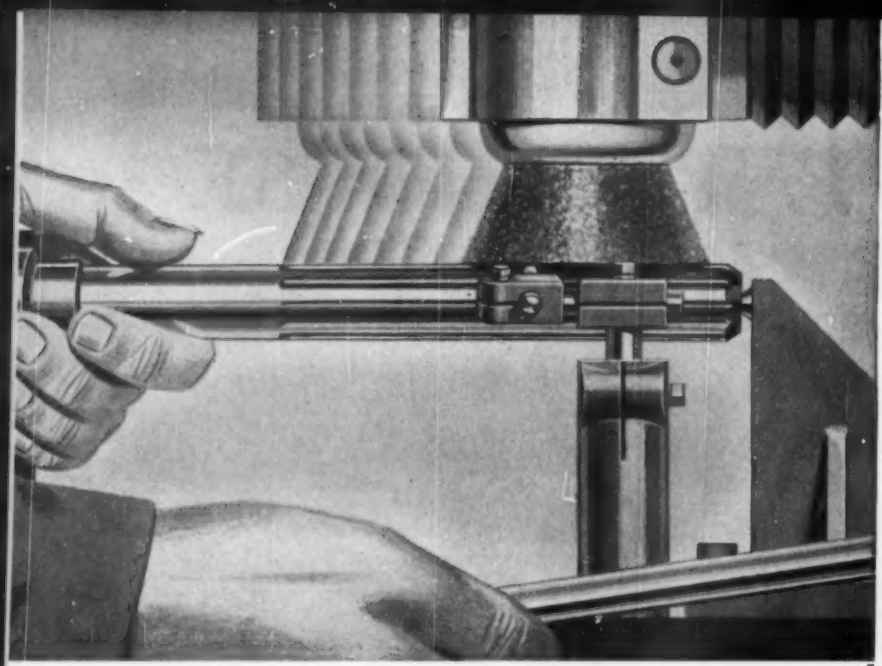
*Trade-Mark



MagnaFlow drives—air cooled (foreground) and liquid cooled—are available in various horsepower ratings for winders, conveyors, fans, pumps, extruders and other machinery in all industries.

Westinghouse

CIRCLE 443 READER SERVICE CARD



OLIVER "ACE" TOOL AND CUTTER GRINDER

Traverses the wheel—not the work!

You can grind tools and cutters more accurately with the Oliver "ACE" because the wheel is brought to the work, reversing the usual process. Abrasive dirt and grit cannot cause wear because the cross carriage is not in motion. The horizontal ram which supports the grinding head is fully enclosed—sealed against dust and dirt. Further accuracy is assured because the wheel is trued by a stationary diamond which provides a fixed grinding line. It is not necessary to reset the cutter to compensate for wheel wear.

The "ACE" is a tool and cutter grinder designed expressly for tool grinding—not a general purpose machine adapted to tool room work. It is simple to set up. All angles are obtained by direct reading. Operators stand in a natural position with the control lever in easy reach and the work in direct view.

Face mills, reamers, end mills, staggered tooth cutters, slab mills, spot facers—all cutters straight or spiral—are quickly, easily and economically sharpened with the Oliver "ACE". Both standard and heavy duty models are extensively used for sharpening carbide-tipped circular wood saws used in both woodworking and metalworking.

Write today for complete information. We'd appreciate the opportunity of sending a quotation.

OLIVER of ADRIAN

1414 E. Maumee St. • Adrian, Michigan

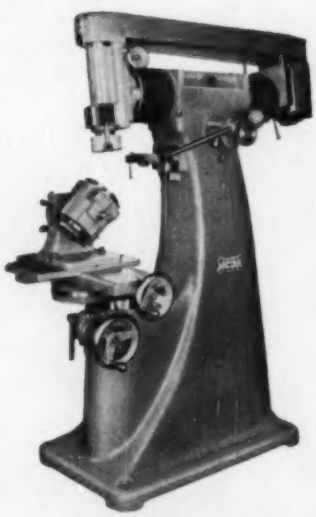
DRILL GRINDERS AND THINNERS—TOOL AND CUTTER GRINDERS—AUTOMATIC AND MANUAL FACE MILL GRINDERS—TOOL BIT GRINDERS—CONTOUR SAWING AND FILING MACHINES

(Advertisement)

HOW TO REDUCE YOUR CUTTING TOOL COSTS

Three elements are absolutely necessary if there is to be a substantial reduction in cutting tool costs—the right tool, the right geometry of grind on that tool, and the right machine to produce the grind. There are various machines which will always be most suitable for specific applications. However, for the average cutter grinder jobs, Oliver has pioneered a new approach to the problem with the introduction of the "ACE" tool and cutter grinder.

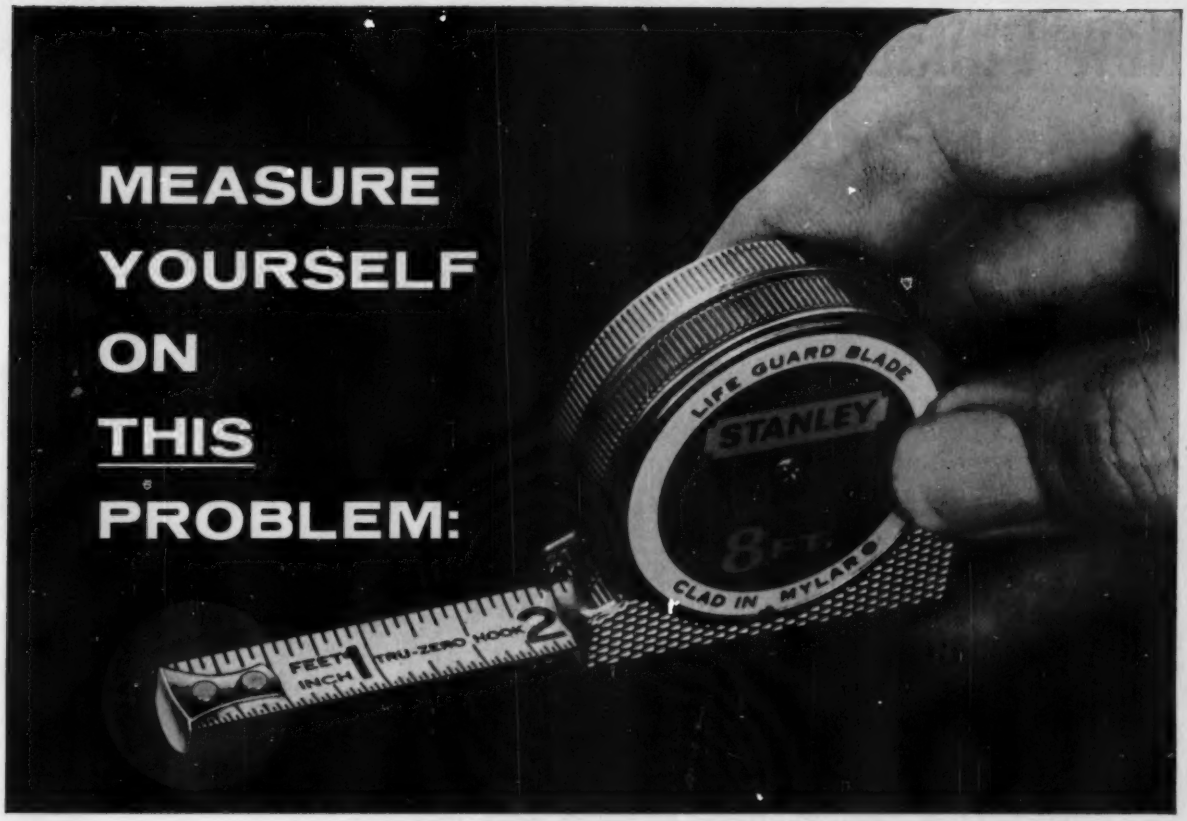
The cost savings are attractive with respect to both setup time and grinding time. Setup usually consists of two simple "direct-reading" adjustments. The first setting is made to produce the angular or straight line grind requirement. The second setting consists of tilting the grinding wheel spindle to produce the proper clearance—all extremely simple.



The Heavy Duty "ACE"

Grinding time is reduced considerably because tool travel is eliminated in most cases. Thus the time consists wholly of bringing the grinding wheel on and off the cutting tool. This compares extremely favorably with competitive grinding procedures.

There are two versions of the "ACE": the standard, which is suitable for high speed and light duty carbide grinding, and the heavy duty model which is designed for grinding tungsten carbide cutters and tools in all of their many forms.



"Make it slide exactly 0.025 inch . . . hold it securely . . . do it at lowest cost"

Stanley got the answer from a TRS man

The hook on the end of a steel tape rule must slide back and forth, exactly enough to offset the thickness of the hook when taking outside or inside measurements. The problem faced by Stanley Tools of New Britain was to put the sliding action in the hook, without making profits slide.

How to avoid the high cost of attaching the hook with screw machine fasteners was the question put to a TRS Engineer, trained in the PAR Process approach to assembly work. His answer saved 31% on fasteners and 8% on per-unit assembly time.

He demonstrated that the precision of standard TRS nickel-plated steel shoulder rivets would fully satisfy the needs of the job. Also, that the two rivets could be automatically fed and set in one operation by a standard TRS double-drive riveter.

Foreign rivets flopped on this job. Stanley was quick to pass the new cost-cutting trick on to their English plant. They shipped a duplicate TRS riveter over and tried foreign-made rivets, but without success. Now, TRS rivets are used in the English operation. TRS has the equipment, skill and quality control to assure reliable precision.

How Precision Slide is Achieved –

Precision-made shoulder rivets pass through oversize holes in rule hook and clinch to metal rule. Hook can slide back and forth by exactly the amount of excess diameter of holes in hook. The excess is equal to thickness of hook.

When you call in a TRS Engineer, you get rivets that save you the high cost of trouble and rejects. And, you get the benefit of an uncommon ability to come up with cost-reducing answers . . . the PAR Process way of simplifying and making assembly more automatic.

Don't Buy Riveting Machines until you learn how the TRS **PAR** *process revolutionizes riveting*

TRS®

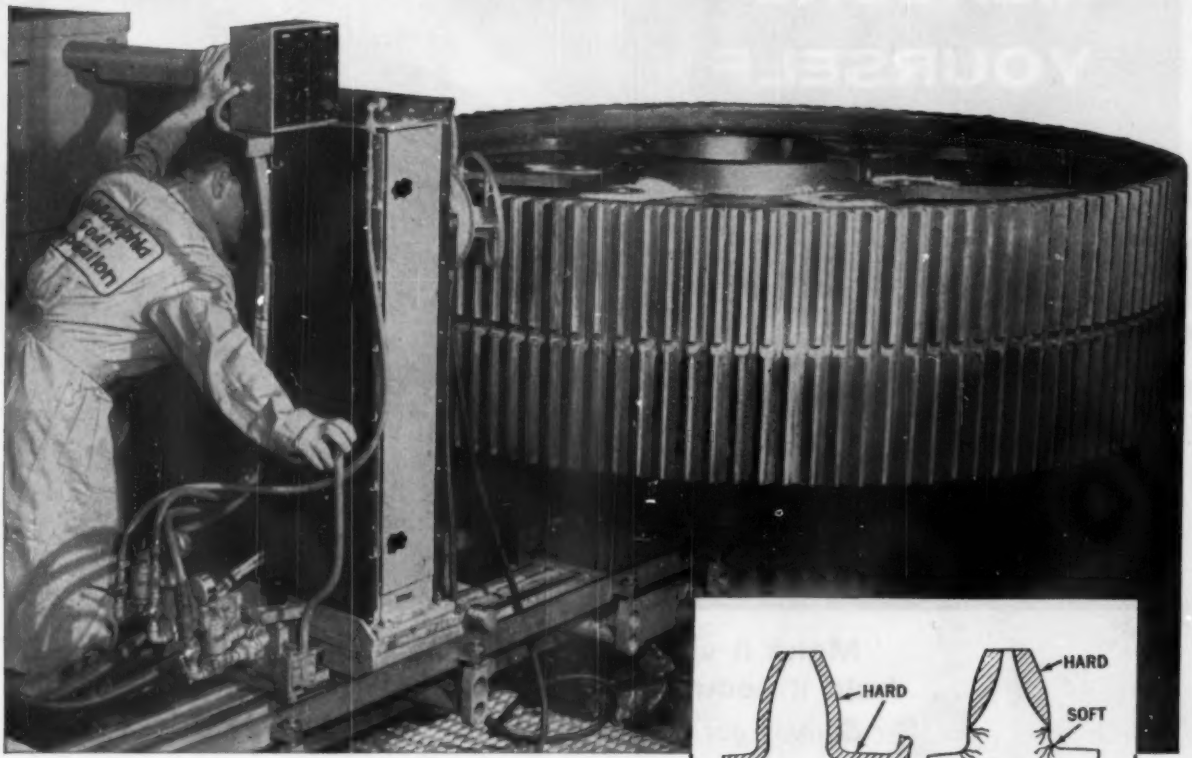
TUBULAR RIVET & STUD COMPANY

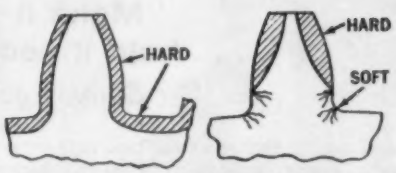
QUINCY 70, MASSACHUSETTS • TRS SALES OFFICES: Atlanta • Buffalo • Charlotte • Chicago Cleveland • Dallas • Detroit • Hartford • Indianapolis • Los Angeles • New York Philadelphia • Pittsfield • Quincy • St. Louis • Seattle. WAREHOUSE IN CHICAGO

See "Yellow Pages" for phone numbers.

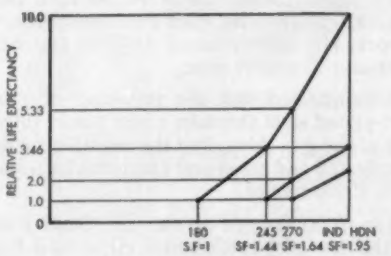
If it's a Tubular Rivet TRS makes it . . . and Better

New Philadelphia induction hardening increases life of large gear drives . . .





New Philadelphia full contour induction hardening (left) provides a continuous hardened area from one tooth flank around the root and up the other flank without interruption. There are no points of stress. Typical heat treated gear (right) shows inadequate hardening of root of tooth, a point of major stress.



This chart shows the relationship between load and gear life. Note that the improved service factor of a gear set may be used to substantially increase gear life, rather than to increase the load.

HERE'S WHY: Full tooth contour induction hardening of large gears provides a uniformly hardened surface from one tooth flank around the root and up the other flank without interruption. Eliminates points of thermal stress concentration. And there is no distortion, a problem of heat treated gearing that requires subsequent grinding.

This new, advanced Philadelphia method permits radical reduction in sizing and/or increased load carrying capacities. And it can easily harden even the largest spur, helical and herringbone gearing up to 180 inches in diameter, 20 inches in face, and 3/4DP.

Learn more about this new method for increasing the service life of your gear drives. Write for your copy of Bulletin 100.

phillie gear® / **PHILADELPHIA GEAR CORPORATION**
King of Prussia (Suburban Philadelphia), Pennsylvania

NEW 'Long Bed' 10" Metal Lathe offers capacity up to 36"

Delta 10" Metal Lathe with Long Bed (36" between centers) available in bench or cabinet models with a complete line of accessories.

Now Delta introduces the "big brother" to the famous 10" Metal Lathe—with a big 36" capacity between centers and an exclusive combination of features that make it the big value in its class.

This new model fills the need for a low-cost, precision lathe capable of handling heavy duty work in production, in plant maintenance shops and in tool rooms. In addition to extra capacity, it provides: variable speed drive with choice of speeds from 50 to 1500 rpm, quick change gear box allowing selection of 54 feed rates or thread pitches, and ¾" collet capacity—largest available in any comparable lathe.

See your Delta Industrial Distributor (listed under "TOOLS" or "MACHINERY" in the Yellow Pages) about the many other extra performance features you get. For FREE catalog describing the complete line of Delta Metal Lathes, write: Rockwell Manufacturing Company, Delta Power Tool Division, 618M N. Lexington Ave., Pittsburgh 8, Pa. In Canada: Rockwell Manufacturing Company of Canada, Ltd., Box 420, Guelph, Ontario.

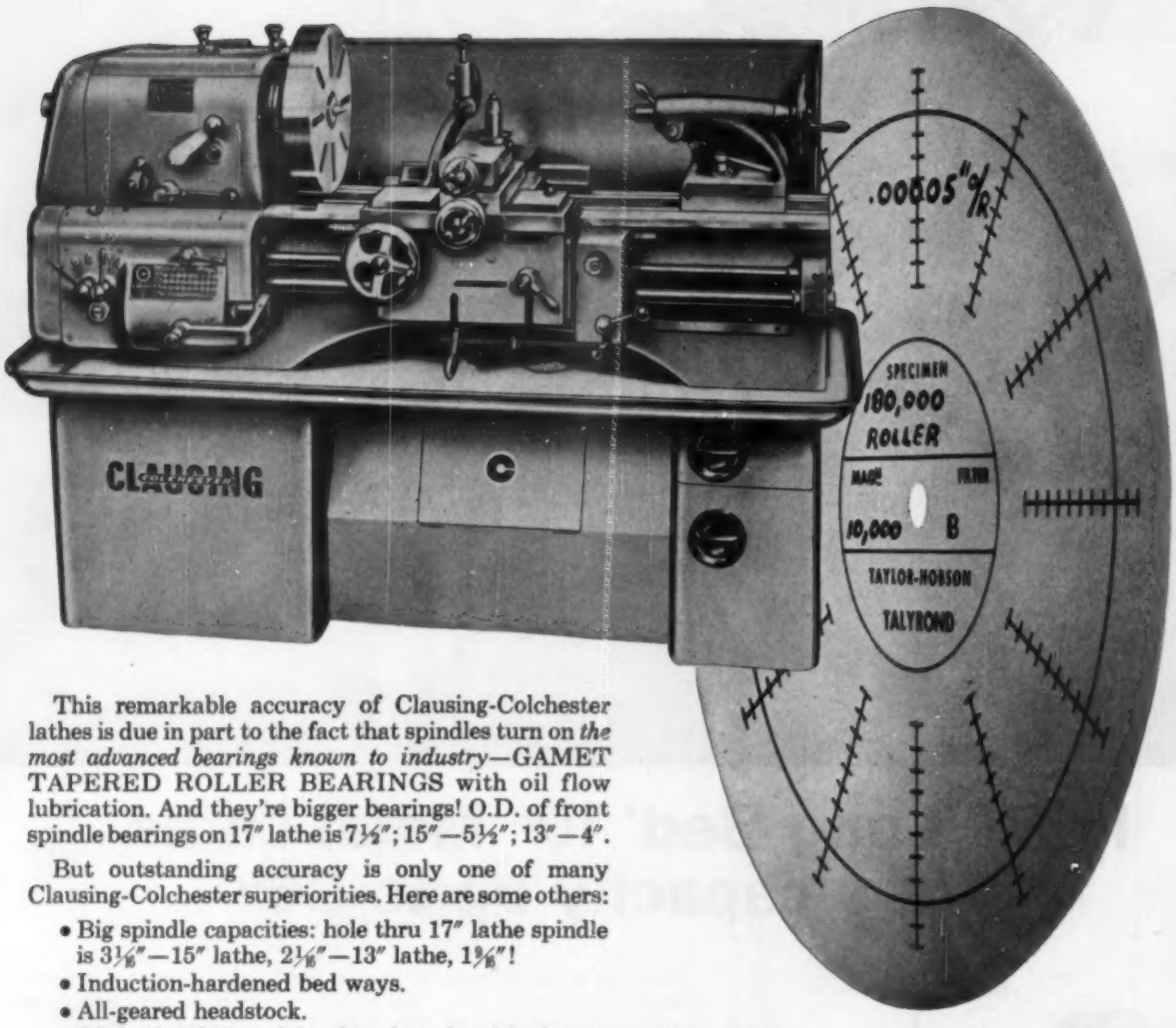
DELTA INDUSTRIAL TOOLS

another fine product by

ROCKWELL

CIRCLE 447 READER SERVICE CARD

CLAUSING COLCHESTER GEARED-HEAD LATHES *turn* ROUND *within* .0001"



This remarkable accuracy of Clausing-Colchester lathes is due in part to the fact that spindles turn on *the most advanced bearings known to industry*—GAMET TAPERED ROLLER BEARINGS with oil flow lubrication. And they're bigger bearings! O.D. of front spindle bearings on 17" lathe is 7½"; 15"—5½"; 13"—4".

But outstanding accuracy is only one of many Clausing-Colchester superiorities. Here are some others:

- Big spindle capacities: hole thru 17" lathe spindle is 3⅛"—15" lathe, 2⅛"—13" lathe, 1⅛"!
- Induction-hardened bed ways.
- All-geared headstock.
- Oil bath lubricated headstock and quick-change gear box.
- Separate feed rod for power feeds.

Best of all, Clausing-Colchesters are the greatest lathe values you'll find anywhere. Prices for the 13" straight bed model start at $2440; 15"—$3415; 17"—$5100. Prices include motor and magnetic controls. Gap bed and profiling lathes available in all three sizes.

Get ALL the facts. Write for descriptive literature on the "Greatest Buys in Lathe History!"

POSITIVE PROOF!

Every Clausing-Colchester must turn round within .0001". Accuracy is checked by inspecting a turned work piece on a Talyrond which measures and records in millionths on a graph like the above. Work piece and graph are supplied with each lathe as proof of its superior accuracy.

356

CLAUSING
DIVISION OF
ATLAS PRESS COMPANY

OUTSTANDING VALUES IN PRECISION MACHINES

12-302 N. PITCHER STREET, KALAMAZOO, MICHIGAN

BY

AUTOMATICALLY FORMING & WELDING

Eliminating multiple machine operations, and the high cost of parts handling and change-over

13 SIZES OF THESE HEAVY-DUTY HOSE CLAMPS

In a high-volume, high-precision process at Cuyahoga Products Corp., with a flexibility permitting rapid shifts from one part-run to another

PRODUCTION TIME HAS BEEN CUT IN HALF

Production has been increased 50%. Easy accessibility and maintainability of tools has reduced down time

AND PROFITS ARE BEING MULTIPLIED

With no strain, and with the sweet click, click, click of profits

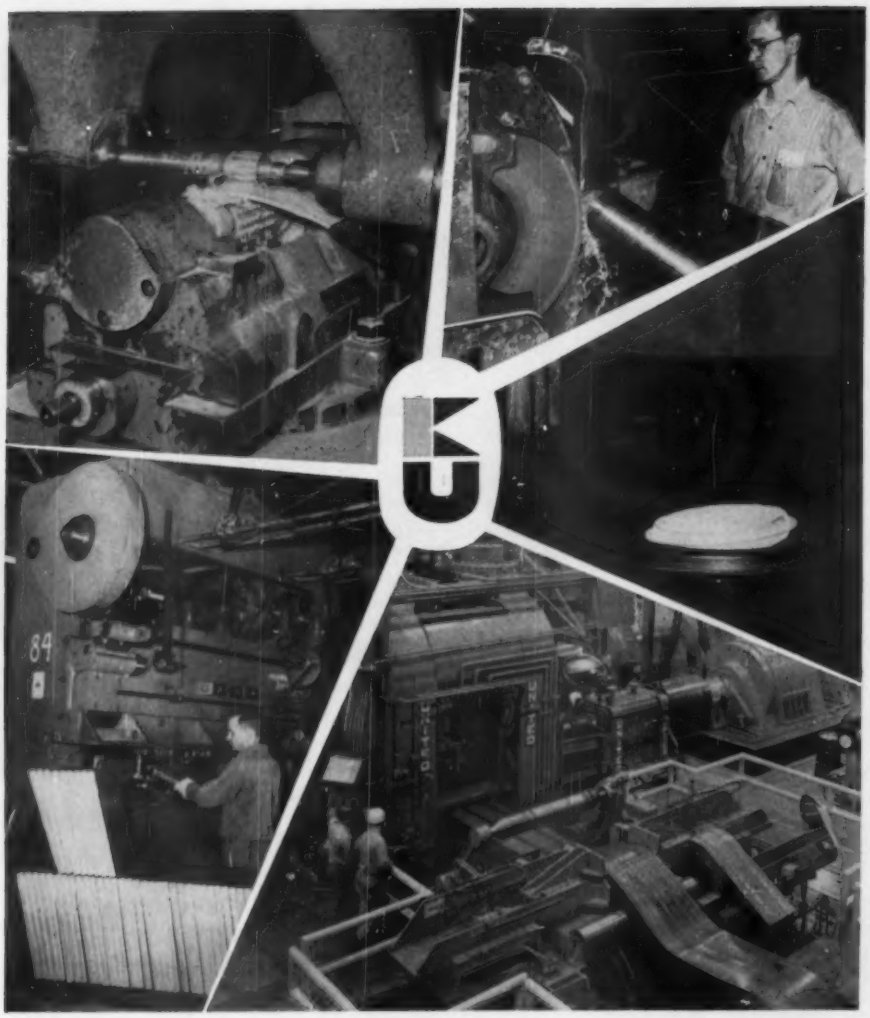
WITH THE VERSATILE NEW TORRINGTON V-82 VERTICAL 4-SLIDE

Secondary operations such as the Cuyahoga hose clamp welding can only be done with such high production on a vertical 4-slide. For the complete story of this new production machine, write —

THE TORRINGTON MANUFACTURING COMPANY

MACHINE DIVISION • Torrington, Connecticut

CIRCLE 449 READER SERVICE CARD



Add your company name to this list of great names in the metal-working world who use Kerns products

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American Motors Corp.
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Borg Warner Corp.
Bridgeport Brass Co.
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Buick
J. I. Case Co.
Caterpillar Tractor
Chase Brass & Copper
Chevrolet
Chrysler Corp.
John Deere Co.
Douglas Aircraft
Dow Chemical
Ford
General Electric
Harnischfeger
Harvey Aluminum Inc.
Hotpoint
IHC
Kaiser Industries
Keystone Steel & Wire
Lockheed Aircraft
Maytag
Minneapolis Honeywell
North American Aviation
Northwestern Steel & Wire
Olin Mathieson Chemical
Pittsburgh Plate Glass
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Remington Rand
Republic Steel
Revere Copper & Brass
Reynolds Metals
Rheem Mfg. Co.
Geo. D. Roper Corp.
Schwayder Bros., Inc.
SKF Industries Inc.
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Whirlpool Corp.
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Youngstown Sheet & Tube

KERNS INDUSTRIAL LUBRICANTS PROVE THEMSELVES AT NO COST TO YOU!

Improved production, maximum machine efficiency, and lower maintenance costs are vital to increased profits. A lubricant . . . the best for your purpose . . . is available for an actual production test run without cost. Kerns United, under their Memo Billing Trial Basis, recommends and supplies a lubricant for testing in your own plant . . . no formal invoice will be rendered unless completely approved in production.

Consult Kerns United now! Get the advantages of a product formulated to blend with *your own* operations.

Manufacturers of Cutting, Grinding, Drawing, Forging, Phosphatizing, Cleaning, Rope, Twine, Wire Drawing and Spray Booth Compounds; Cling Oils, Rolling Oils, Rust Preventives and Specialized Greases.

Write now for further information on any of these products—no obligation, of course.

World's Largest Exclusive Manufacturer of Specialized Industrial Lubricants

KERNS UNITED Corporation

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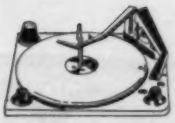
Subsidiary: KERNS PACIFIC Corporation, *630 N. Batavia St., Orange, California*

Offices in Principal Cities throughout the U.S.A.

Sweet Music for Tomorrow

Machining a turntable in the Model Shop of V-M Corporation, Benton Harbor, Michigan.

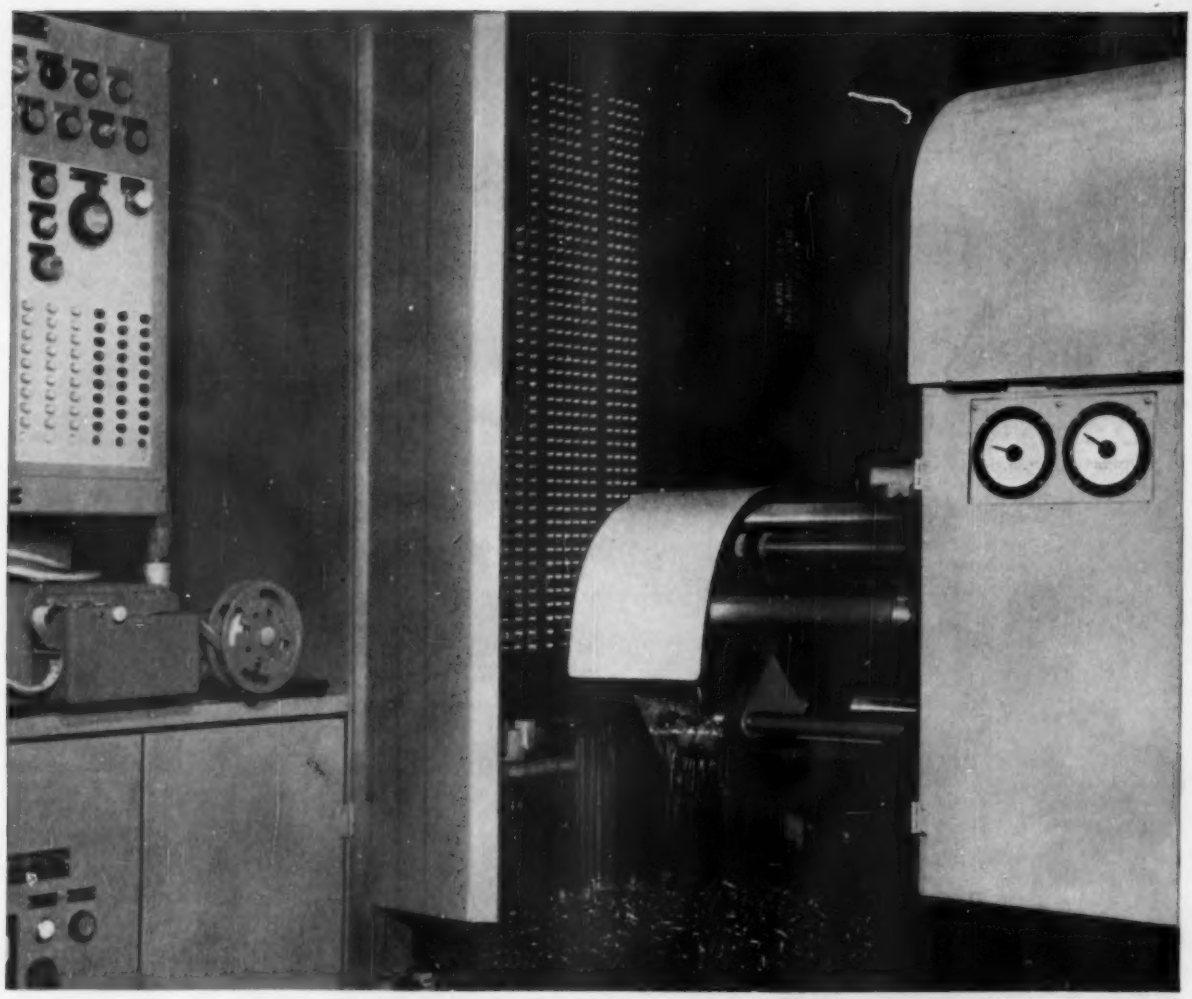


Just as manufacturers the world over choose famous V-M Record Changers for their dependability and full fidelity of performance, V-M chooses South Bend 13" Toolroom Lathes. They demand exacting model work and they get it on these precision lathes—every time. If your experimental or production work require exceptional tolerances and fine finishes, you'll be interested in what you can accomplish on South Bends. *Write now for complete information.* Prices of 13" Toolroom Lathes start at $2358, a time payment plan is available.

SOUTH BEND LATHE

SOUTH BEND LATHE, Inc.
South Bend 22, Indiana

Builders of Lathes • Milling Machines • Shapers • Drill Presses • Pedestal Grinders



"40 IPM AT *875 RPM*... WE WERE AMAZED"/ *says Walter P. Hill*

DATA:	1020 LEDLOY LEADED PLATE 1½" THICK	1020 NON-LEADED PLATE 1½" THICK
PENETRATION RATE Production Run	40 IPM	20 IPM
DRILL SPEED Production Run	875 RPM	750 RPM
MAXIMUM IPM Test Run	up to 47	up to 28
CHIP CHARACTERISTICS Thickness · Temperature Type	.060—.080 cool broken	.040—.060 cool curled

"Ours is a specially designed numerically controlled jig drilling machine with which we obtained penetration rates of 20 Inches Per Minute at 750 RPM in standard half-inch thick 1020 steel plate. However, with the same set-up, we easily obtained 40 IPM at 875 RPM in INLAND LEDLOY leaded steel plate three times as thick and with far better tool life.

■ "Actually, in LEDLOY, we reached penetration rates of 46 and 47 IPM but consider the 40 IPM more practical for production runs. Our programmed test run was made on steady plates for large condensors in which 1½" LEDLOY steel plates were used. As a control, equivalent drillings were made in non-leaded plates of the same chemistry and the same thickness. Our load meter showed the same pulled load on LEDLOY at 40 IPM as we pulled on the non-leaded plate at 20 IPM. Tool life using LEDLOY plates at 40 IPM was equal to tool life using non-leaded plates at only 20 IPM.

■ "We conclude, and without hesitation state, that LEDLOY displayed a marked improvement."

Walter P. Hill, President
WALTER P. HILL, INC.
DESIGNERS AND BUILDERS
SPECIAL AUTOMATED MACHINES
DETROIT, MICHIGAN

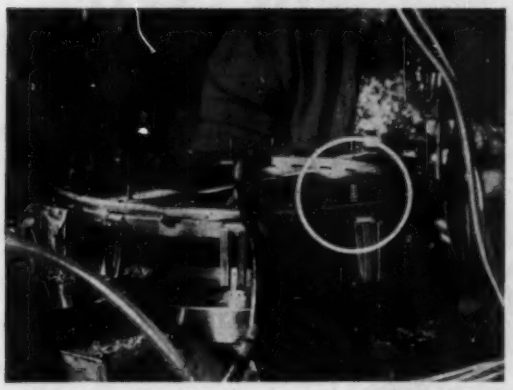
LEDLOY®
the world's most machinable steels

INLAND STEEL COMPANY
30 West Monroe Street, Chicago 3, Illinois

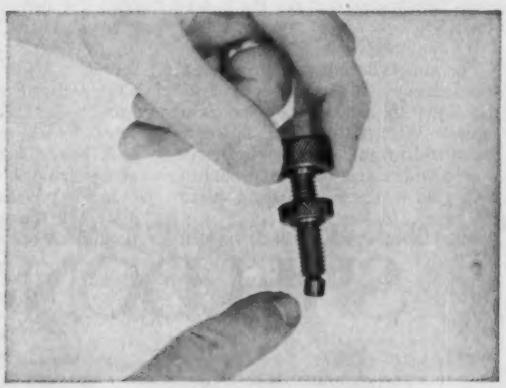
Practical Tooling Tips

No. 3 of a series

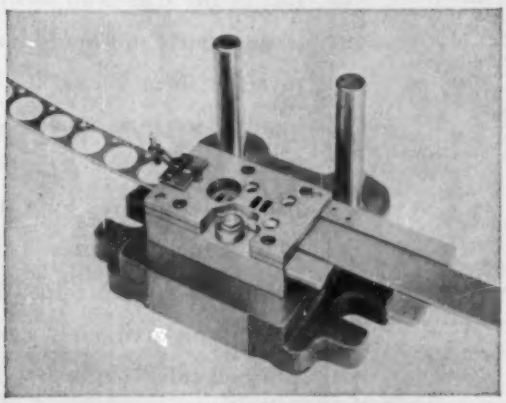
Are your tool makers wasting time making complicated tooling gadgets when a standard, off-the-shelf Vlier part could do the job much better? Why not examine your present drawings and see where these simple, low-cost parts can be used. You will be amazed at the savings possible.



PRODUCTION INCREASED 300% when this 12-station automatic indexing and tapping fixture was put to work. Vlier Spring Plungers allow the operator to load by simply pushing the part into a slot. These simple, spring-loaded tools also position the part for the tapping operation. Available in four models; fifty sizes.



NEW SWIVEL PAD-TORQUE THUMB SCREW combines the Vlier Torque Thumb Screw and Swivel Pad Clamp. The result is a perfect holding tool—one that applies only the right amount of holding pressure without damaging the finished surface. Unique ball joint construction of the pad permits adjustment to off-angle surfaces.



PROPER STOCK ALIGNMENT IN PROGRESSIVE DIES becomes a simple task with the new Vlier Stock Pusher. Saves pilots. Mounts in tapped hole. Accommodates stock as thin as .010"; width variations totalling 1/16". Nothing to wear out or foul up.

NEW 1960 CATALOG NOW AVAILABLE—Eight pages, completely revised. Includes information and specifications on all new Vlier products, including the Torque Handle, Stock Pusher, Leveling Pad. Makes ordering easy. Suggests new uses for these proven time-savers. Write for your copy today!

VLIER
Engineering Corporation
A subsidiary of Barry Controls, Inc.
8900 Santa Monica Blvd. • Los Angeles 46, California

PUSH BUTTON *Speed Selection*

from **to** **in seconds**

or to *any* intermediate speed, *instantly*

Just push a button and watch the large tachometer dial on the headstock!

It's that easy!

The work is done by a motor driven speed changer. It accelerates or slows the lathe to any desired speed in seconds. With a 10:1 ratio, this new variable drive makes it easy to select from a wide range of speeds—200 to 2000 rpm in direct drive and 40 to 300 rpm in back gear.

Maximum stability and smooth power transmission are assured because the drive unit is oversized. All pulleys and shafts are fully supported (eight bearings). Double V-belts throughout the drive eliminate slippage and deliver full power to the spindle. Because of this rigidity and extra pulling power, this lathe will take heavy cuts at all speeds and precision finish cuts at high speeds.

It is a precision lathe, moderate in price, with the versatility for toolroom, production or second operation jobs.

SHELDON *Variable Speed* PRECISION LATHES

Illustrated
WM56P
13" Swing- 34" Centers

Write for

"Variable Speed" Circular and General Catalog showing . . .

•

10", 11", 13" and 15" SHELDON Precision Lathes (Bench, Pedestal and Cabinet types)

•

13" and 15" SEBASTIAN Geared Head Lathes

•

SHELDON Milling Machines

•

SHELDON Back Geared Shapers

SHELDON MACHINE CO., INC.
4234 N. Knox Ave. • Chicago 41, ILL.

CIRCLE 454 READER SERVICE CARD

Popular package is 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench; metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

Write for sample on company letterhead

THE DYKEM COMPANY
2301B North 11th St. • St. Louis 6, Mo.

HOW TO WRITE BETTER REPORTS

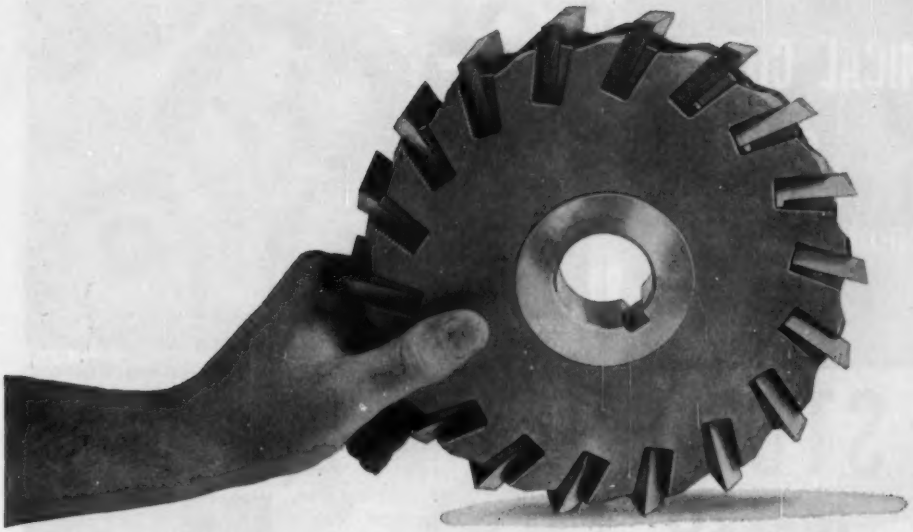
To anyone who has ever fought his way through a foggy, long-winded, difficult to read report, this booklet will appear to have been published years late.

But to the man who has to write reports and would like to make them better, it's a handy working tool. A pocket-sized 26-pager, the booklet is authored by AM/MM Associate Editor Tom Johnson—a man trained in simplifying extremely complicated subjects.

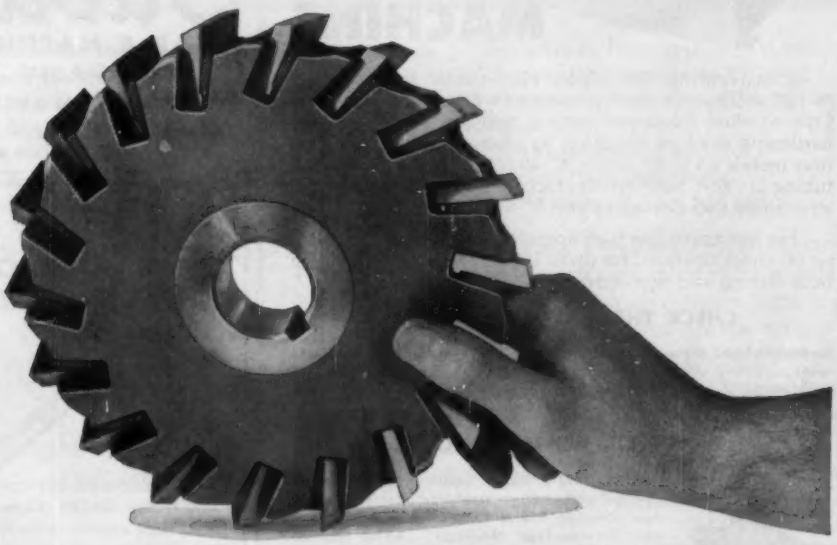
You can secure a copy for 50c from Reader Service Department

American Machinist / *Metalworking Manufacturing*

330 West 42nd Street
New York 36, N. Y.



Which cutter will produce fewer rejects?



LOOK TO INGERSOLL FOR THE ANSWER

You haven't a chance to choose . . . both pictures show the same cutter! You see, there are many factors, other than cutter design, that can affect machining adversely and turn a piece into a reject.

But you do have the chance to prevent trouble by analyzing all factors involved, in advance. Firms that rely on Ingersoll to assist in setting up procedures find the economical answers that hold costly rejects to a minimum or eliminate them entirely.

Let an Ingersoll representative help you with a preliminary survey of your metal removal practices. It will cost you nothing . . . could lead to important savings. Ask a representative to call, or write for the booklet, "Ways to Reduce the Cost of Chips." Address Dept. K-68.

THE **INGERSOLL**
MILLING MACHINE COMPANY **CUTTER DIVISION** ROCKFORD, ILLINOIS

FAST, ECONOMICAL CUTTING

of ferrous, non-ferrous, non-metallic solids and shapes

STONE

M-120

manual or automatic

CUT-OFF MACHINE

A heavy-duty, 20"-blade, chop-stroke machine, the M-120 will handle your heaviest jobs better in faster time. Cuts to close tolerances with a mill-like finish, without hardening stock or changing its characteristics. Cuts ferrous metals up to 4" solids, 6" structurals and heavy-wall tubing . . . and non-ferrous metals up to 6" solids, 8" structurals and extrusions and 6" heavy-wall tubing.

For automatic bar feed operation the M-120 is electro-air oil-check operated for up to 1600 cuts per hour through both ferrous and non-ferrous metals.

CHECK THESE STONE FEATURES

Geared-in-head motor (a Stone exclusive) . . . fast-acting, self-centering vises . . . heavy cast machine-surfaced table for jigs and fixtures . . . wide range of gear ratios for proper spindle speed . . . all mist spray for non-ferrous cutting.

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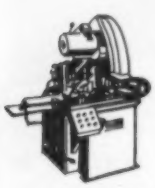
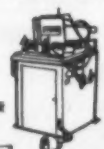
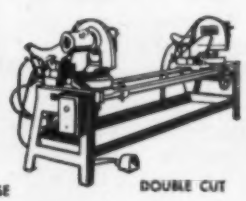
Used by every major industry throughout the civilized globe, Stone machines offer the world's most complete line of Chop-Stroke, Double Miter and Traverse-Type Machines . . . either manual, semi — or fully automatic or custom-built. All fully described in new literature featuring latest developments and improvements. Send for it today.



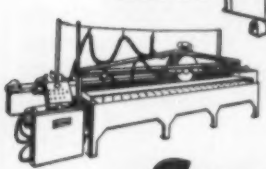
AUTOMATIC CHOP STROKE



DOUBLE MITER



DOUBLE CUT



TRAVERSE

Stone MACHINERY CO., INC.
151 FAYETTE ST., MANLIUS, N. Y.
HIGH SPEED CUTTING MACHINERY

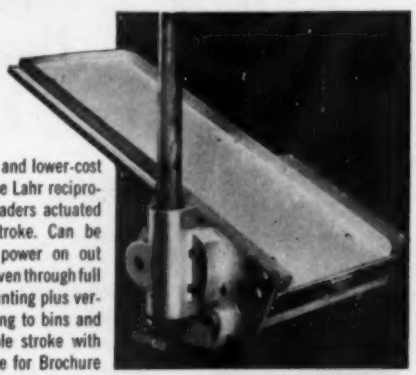
Rubber Mill Drive requirements dictated the specifications of this Meehanite spur bull gear—72½" O.D., 12" F., 143 T., 2 D.P., H-type arms. Stahl has the experience, the ability and the precision equipment to guarantee unfailing accuracy on every job. Prompt delivery and moderate cost, too. For gears—any size, type or quantity—get Stahl's estimate first.

SPURS TO 72" PD. 1 DP.
BEVELS TO 54" PD. 1 DP.
SPIRAL, HELICAL and WORM GEARS TO 48" PD. 2 DP.
CONTINUOUS TOOTH HERRINGBONE TO 60" PD. 2 DP.
SPROCKETS TO 72" PD. 2½ CP.
RACKS TO 20 FT. LONG. 3 DP.
SILENT GEARS: RAWHIDE, BAKELITE, FIBROIL
HEAT TREATED CASE OR FLAME HARDENED GEARS—OF CARBON OR ALLOY STEEL

Stahl
GEAR & MACHINE COMPANY
3901 HAMILTON AVENUE
CLEVELAND 14, OHIO

CIRCLE 459 READER SERVICE CARD

NEW
PART UNLOADERS REDUCE HANDLING



For fast, positive and lower-cost blank removal, use Lahr reciprocating chute unloaders actuated by your press stroke. Can be cable-timed (air power on out stroke) or rack-driven through full cycle. Simple mounting plus versatility of unloading to bins and conveyors. Variable stroke with gear change. Write for Brochure and Prices.

Model 20-59 shown

STANDARD MODELS AVAILABLE

Model No.	Tray Width	Tray Stroke	Power In	Power Out
20-RR-59	10" to 36"	10" to 20"	Rack	Rack
20-CT-59	10" to 36"	10" to 30"	Cable	AirCycle
30-RR-59	10" to 72"	12" to 30"	Rack	Rack
30-CT-59	10" to 72"	12" to 30"	Cable	AirCycle

Special tray widths and strokes available

Lahr MACHINE & TOOL CORP.
3400 MAPLEWOOD AVE. — TOLEDO 10, OHIO

CIRCLE 458 READER SERVICE CARD

CIRCLE 460 READER SERVICE CARD

MOORE ROTARY TABLES

For angular spacing jobs so precise you could never handle them before

NO. 2 ULTRA-PRECISE TABLE

Reads direct to 1 sec.

Total error in any position: 2 sec.

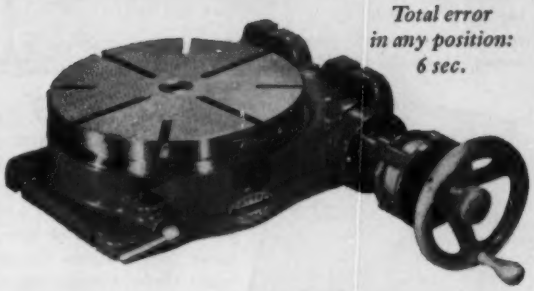
GUARANTEED POSITIONING ACCURACY FOR SHOP USE

All points in 90° increments, from zero to ± 1 sec.
All points in 18° increments, from zero to ± 1½ sec.
All points in 2° increments, from zero to ± 1¾ sec.
Worm accuracy—¼ sec.
Repetition of settings—½ sec.
Total error in any position—2 sec.
2 sec. = 0.00005" (½ tenth) on 10" dia.

Now...with this new No. 2 Moore Ultra-Precise 11-inch 2 sec. Rotary Table—you can provide the closest precision angular spacing needed today. It reads to 1 sec. and has an overall performance accuracy of ± 2 sec. throughout the entire 360°. It is being widely used in angular locations for guidance systems. A nondisengageable, thread-ground worm, combined with the accurately spaced teeth of its mating gear, makes this extreme precision possible. Loss of accuracy, due to repeated throwing in and out of the worm, is eliminated.

NO. 2 PRECISION TABLE

Reads direct to 5 sec.



Total error in any position: 6 sec.

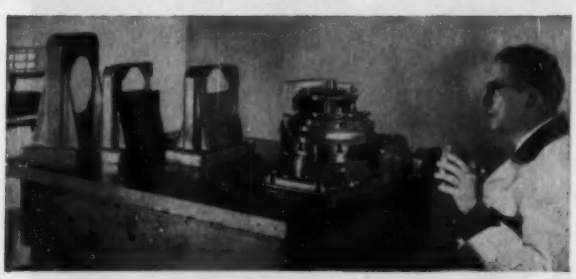
GUARANTEED POSITIONING ACCURACY FOR SHOP USE

All points in 90° increments, from zero, ± 1½ sec.
All points in 18° increments, from zero, ± 2 sec.
All points in 2° increments, from zero, ± 4 sec.
Worm accuracy—2 sec.
Repetition of settings—1 sec.
Total error in any position—6 sec.
.6 sec. = .00015" (1½ tenths) on 10" dia.

This popular No. 2 Moore Precision 11-inch Rotary Table has an overall performance accuracy of ± 6 seconds throughout the entire 360°, and reads direct to 5 sec. It is being used successfully by leading companies on government-sponsored precision jobs never before accomplished. You can use this rotary table for countless precision spacing applications on jig borers and jig grinders.

• • •

Write today for descriptive literature about the Moore 2 sec. Ultra-Precise *and 6 sec.* Precision *Rotary Tables.*



Accuracy assured by interferometric inspection and calibration, the first time industry has used light-wave measuring methods for precise division of the circle.

These rotary tables are accurate in either horizontal or vertical position. Further applications are possible by using the table in conjunction with its companion unit, Model No. 2 Sine Plate.

MOORE SPECIAL TOOL COMPANY, INC.
738 Union Avenue, Bridgeport 7, Connecticut

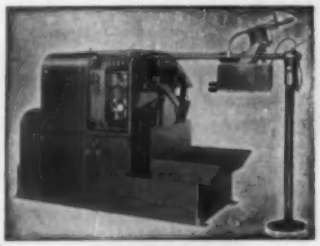
ADD MOORE TOOLS TO YOUR TOOLROOM

JIG BORERS • JIG GRINDERS • PANTOGRAPH WHEEL DRESSERS • PRECISION ROTARY TABLES • HOLE LOCATION ACCESSORIES

FASTER AUTOMATIC CUT-OFF Tubing, Pipe and Bar Stock

The Modern Way

Automatic operation—from loading to final cut-off. Handles solid bar stock up to 3" O.D.—tubing up to 8" O.D. Cuts any material that can be turned. 16 spindle speeds.



CATALOG

Has complete specifications of all models. Illustrates parts that are being formed, grooved, flanged or chamfered and cut off in a single operation at a high rate of speed. Also describes the automatic feeder, hot spinning machine for sealing ends of tubing, and the Modern Safety Drill Table.

108 WRITE

MODERN MACHINE TOOL CO.
2005 Lasey, Jackson, Michigan

CIRCLE 462 READER SERVICE CARD

THINK of it!

NOW you can have a boring head that will **BORE, FACE, TURN** and **GROOVE** at no higher cost than you would pay for an ordinary, single purpose boring head

THINK

This over before buying that NEW head!!

A Boring Head That Won't Face is NOT Complete

Model "D"

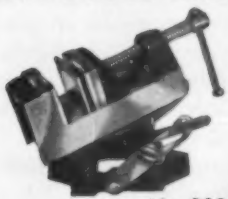
Models for Any Size Machine
Write today for full details
CHANDLER TOOL COMPANY
MUNCIE, INDIANA

Chandler-Duplex

COMBINED BORING AND FACING TOOLHEADS

CIRCLE 464 READER SERVICE CARD

New Stanley-Yankee Vises cut costs at bench and machine



No. 4993A
Swivel-Tilt Vise
3" Jaws

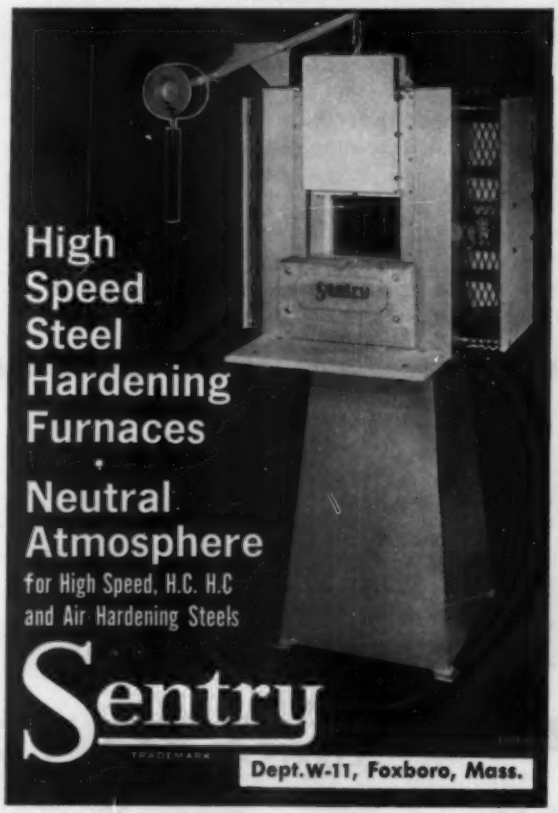
No. 993A
Utility Vise
3" Jaws

New No. 4993A Swivel-Tilt Vise combines swivel base and angle base for quick compound angle set-ups. The exclusive dovetail slot in the vise permits adjustment the full length while retaining the swivel feature. Vise can be detached from swivel-tilt base quickly and easily.

New No. 993A Utility Vise with 3" Jaws—precision-built for machine shop use.

Vises and bases are available separately. Ask your industrial supply distributor for details, or write Stanley Tools, 9311 Elm St., New Britain, Connecticut.

STANLEY The Tool Box of the World



CIRCLE 463 READER SERVICE CARD

CIRCLE 465 READER SERVICE CARD

The prettiest tool-maker at Pratt & Whitney

She probably wouldn't know a micrometer from a hairpin, but using that Friden Flexowriter®, she's preparing a numerical control program tape which helps speed production of tools that are faster, more reliable and far more accurate than ever before.

Today, Pratt & Whitney Company is building five different types of numerically controlled machine tools—*and using numerically controlled tools to do much of the work!*

Significantly, Pratt & Whitney now uses eight-channel punched paper tape control exclusively. After much experimentation, P&W, like so many others in the field, has chosen punched paper tape as the best all-around input medium. Reliable, dependable, easy-to-program—punched paper tape is fast becoming the one thing that most numerically controlled tools have in common.

THIS IS PRACTIMATION: The Friden Model NC-1 Flexowriter is a perfect example of what we call PractiMation—automation so hand-in-hand with practicality there can be no other word for it.

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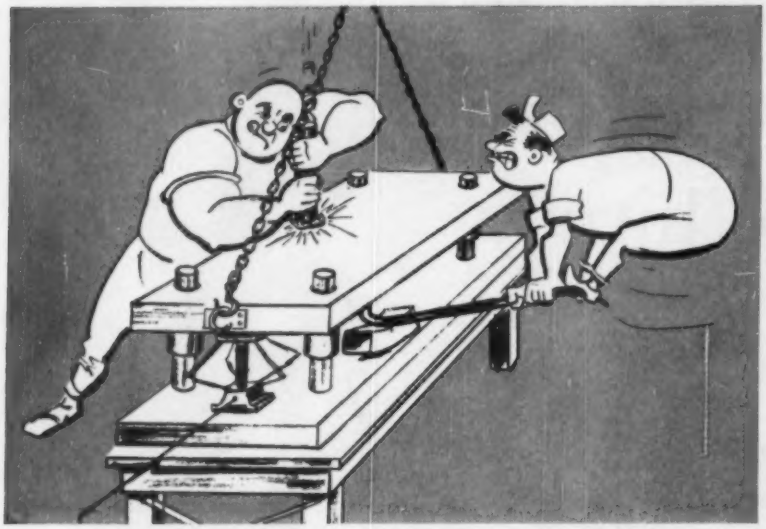
FOR FURTHER INFORMATION WRITE TO FRIDEN, INC., SAN LEANDRO, CALIF.
SALES, SERVICE AND INSTRUCTION THROUGHOUT THE U. S. AND THE WORLD

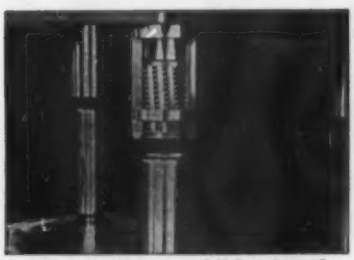
Friden Creates A New World for Business

Friden

DON'T KNOCK YOURSELF OUT WITH STICKY DIE SETS!



Dieco Ball Bearing Die Sets take all the strain out of die making!



NO PAIN...NO STRAIN...and it is extremely accurate! These precision die sets give you burr-free parts and longer production runs – thanks to their "negative clearance." (Cutaway shows how ball-bearing bushing rides on the pin.)

Try a Dieco ball-bearing die set on that next job; you will actually see the punch holder g-l-i-d-e on and off. Folks tell us working with Dieco is almost like taking a two-week vacation. It's that easy.

Management likes them, too. The pre-loaded bushing eliminates die shifting, protects the dies, and gives longer runs between grinds. These sets are assembled in the conventional way; pins are in the shoes. We will sell you complete sets, or just the components, so you can convert the friction bushing sets you now have.

dieco DIE SETS

E. W. BLISS COMPANY
DIE SUPPLY DIVISION
1400 Brookpark Road
Cleveland, Ohio

CIRCLE 467 READER SERVICE CARD

GRANT

RIVETERS — PIONEERS in their line — head rivets from smallest to ¾" diameter either by NOISELESS SPINNING or VIBRATING HAMMER method — Sizes to meet all needs — Types include Vertical and Horizontal Multiple Spindles.

Write for literature and don't forget to send samples.

THE GRANT MFG. & MACHINE CO.
85 Silliman Ave., Bridgeport, Conn., U. S. A.

Material you can use

VALUABLE EDITORIAL REPRINTS FROM AM/MM

A simple note and 35 cents will bring you a copy of any of the following reprints from American Machinist/Metalworking Manufacturing:

Techniques to Lower Short-Run Costs. How numerical control, automatic tool changing and work transfer plus good process planning can spell the answer to ever-increasing short-run costs. A 16-page reprint for 35¢.

How Round is Round—a 12 page compendium of roundness opinion, advice and methods. A 12-page reprint for 35¢.

Ultra-High-Speed Machining — what happens when you cut metal at speeds above 100,000 sfpm. A 16-page report on Lockheed's research for the Air Force. 35¢.

Reader Service Department

American Machinist / Metalworking Manufacturing

330 West 42nd Street
New York 36, N. Y.

AVAILABLE FROM STOCK

. . . Kennametal* Boring Bars with adjustable and interchangeable heads

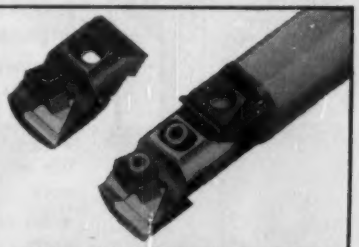
No need for adjustable head on machine... adjustment is made on the tool itself

Featuring the Kendex* "throw-away" insert principle, Kennametal Adjustable Boring Bars are now available with two and three heads that can be used interchangeably on two different styles of bars. Both bars are made in seven diameters, ranging from 1 to 2½ inches. One style is made with a solid steel shank, while the other utilizes the exclusive K-Bar construction to provide greater rigidity for high precision boring jobs.

The Kennametal Adjustable Boring Bar is ideally suited for all types of chucking machines, semi-automatic lathes and precision boring applications on many other machines. This design brings new ease of simple, accurate adjustment, without sacrificing rugged strength or rigidity. A unique gib, plus the improved method of anchoring the cutting head to the bar give maximum strength. At the same time, the fine, precision adjustment permits simple setting and positive holding of close tolerances.

Standard Kendex throw-away inserts provide the many mechanical advantages and cost-reducing features of Kendex tooling. The snug fitting shim and chipbreaker leave no gaps in which chips can jam. For maximum support and durability, both are "all carbide" . . . as strong as the insert itself.

Get more information on the new line of Kennametal Adjustable Head Boring Bars. Call your Kennametal Representative, or write KENNAMETAL INC., Latrobe, Pa.



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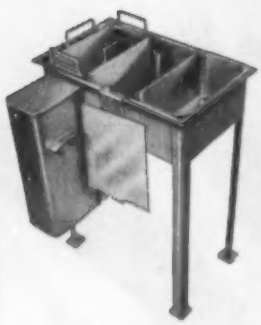

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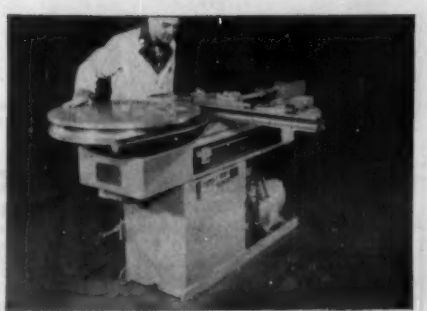
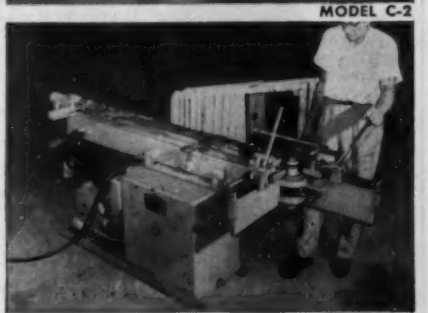


MODEL C-2



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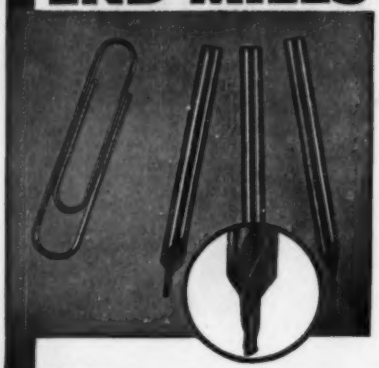

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3. Automatics
4. Balancing Machines
7. Boring Mills
8. Broaching Machines
10. Centering Machines
11. Chucking Machines
17. Drilling & Reaming Machines
20. Fabricating Equipment
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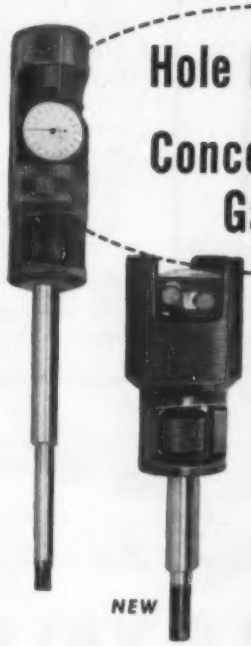

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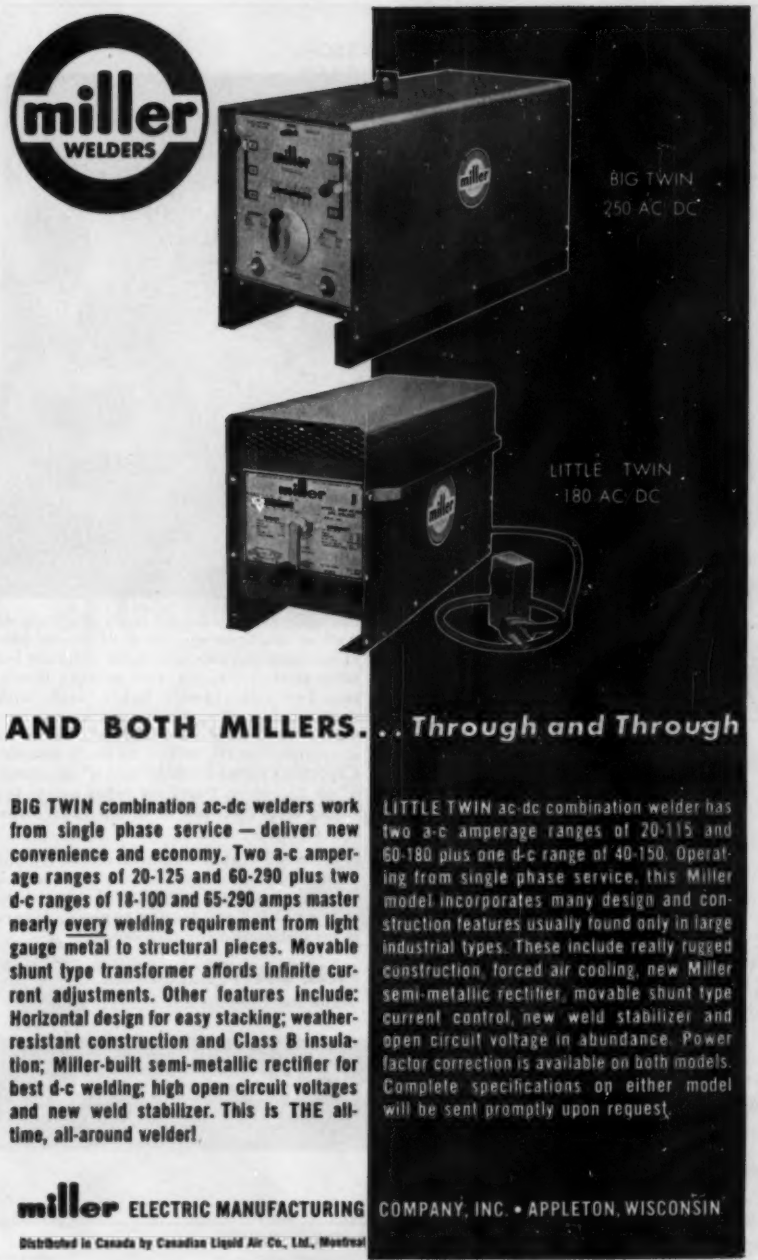

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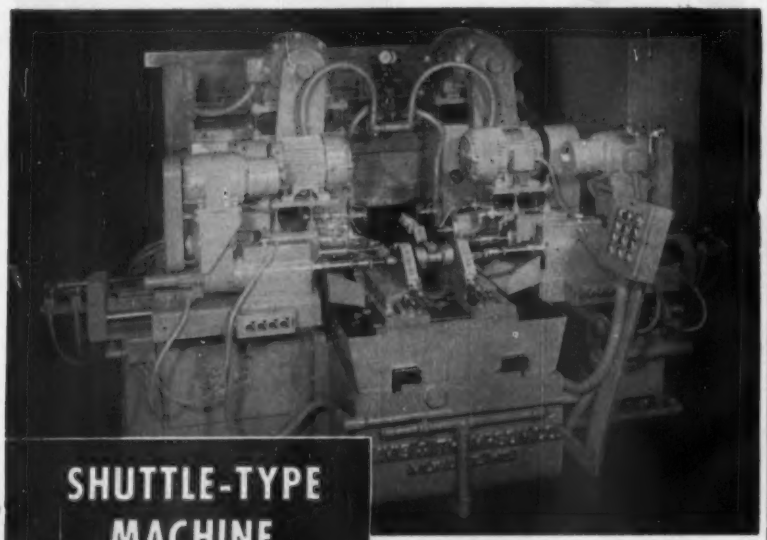

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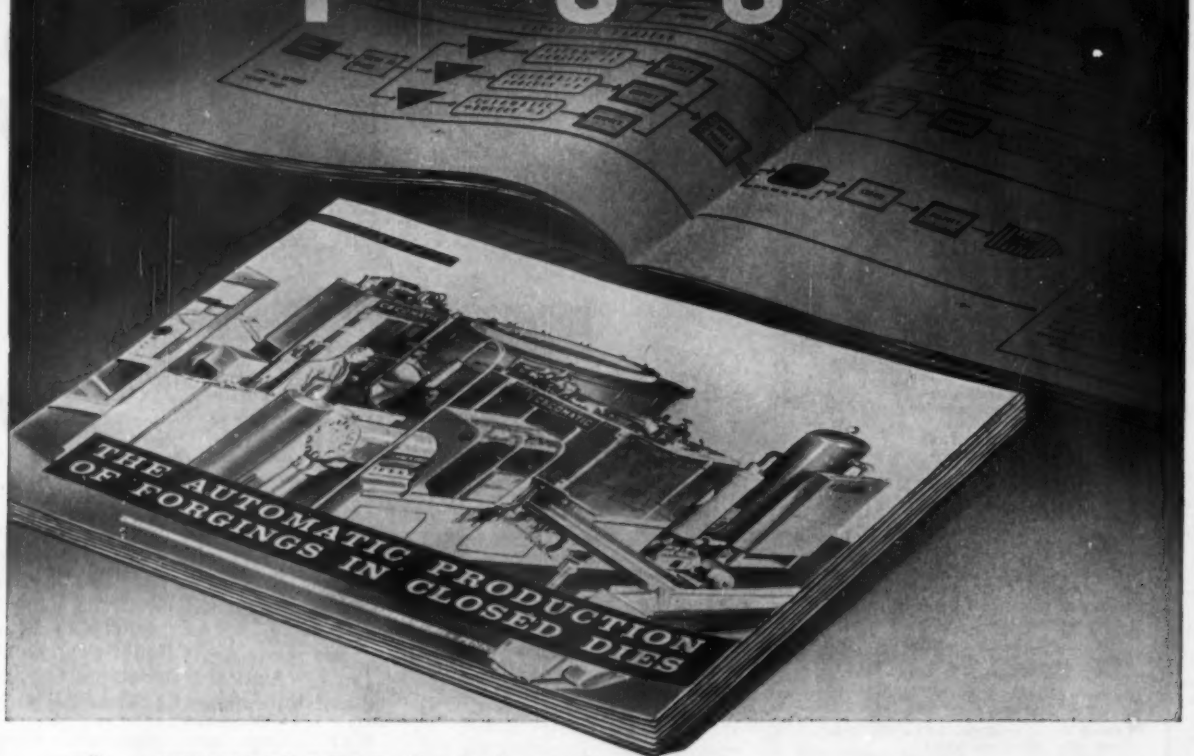

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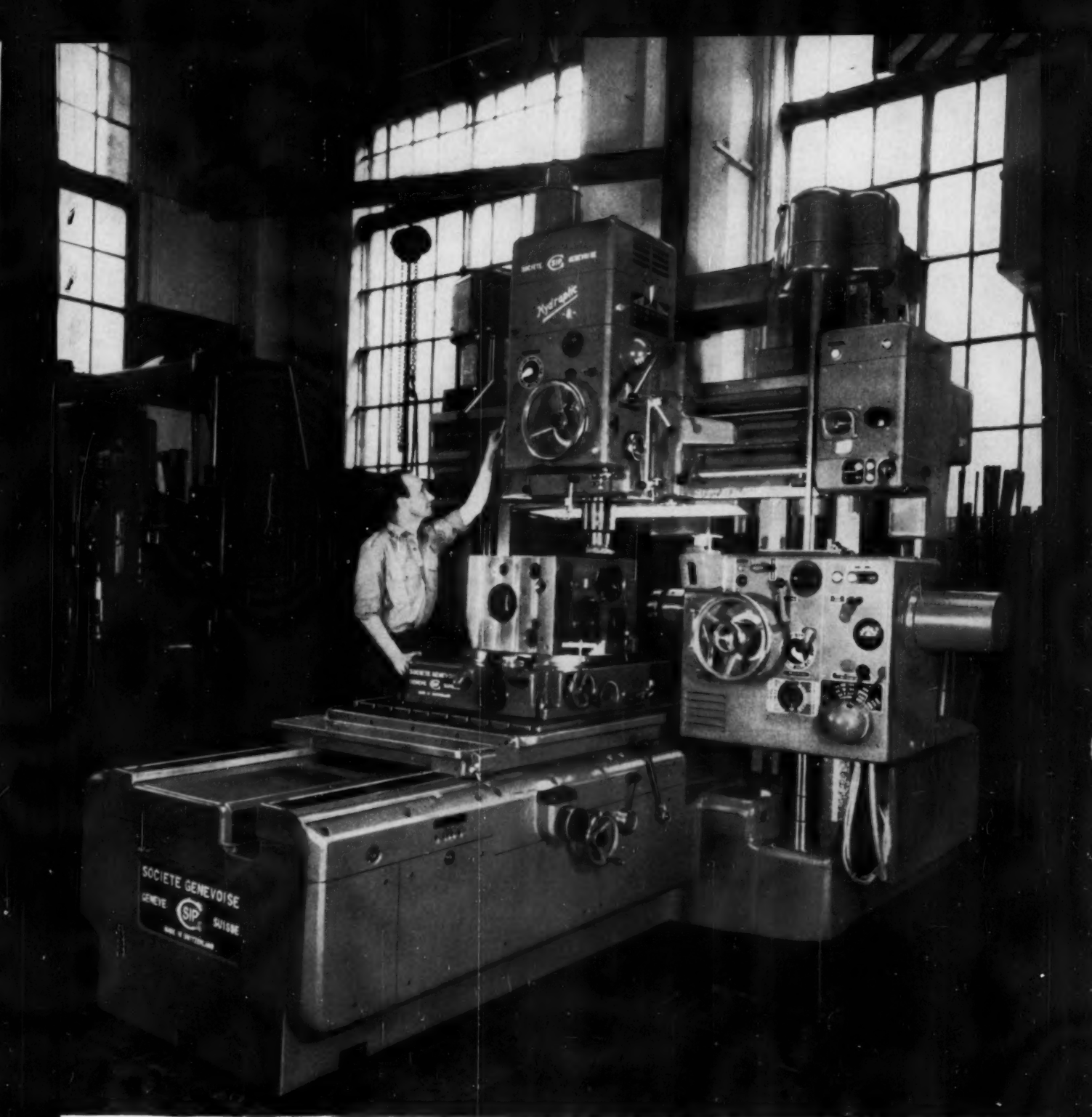

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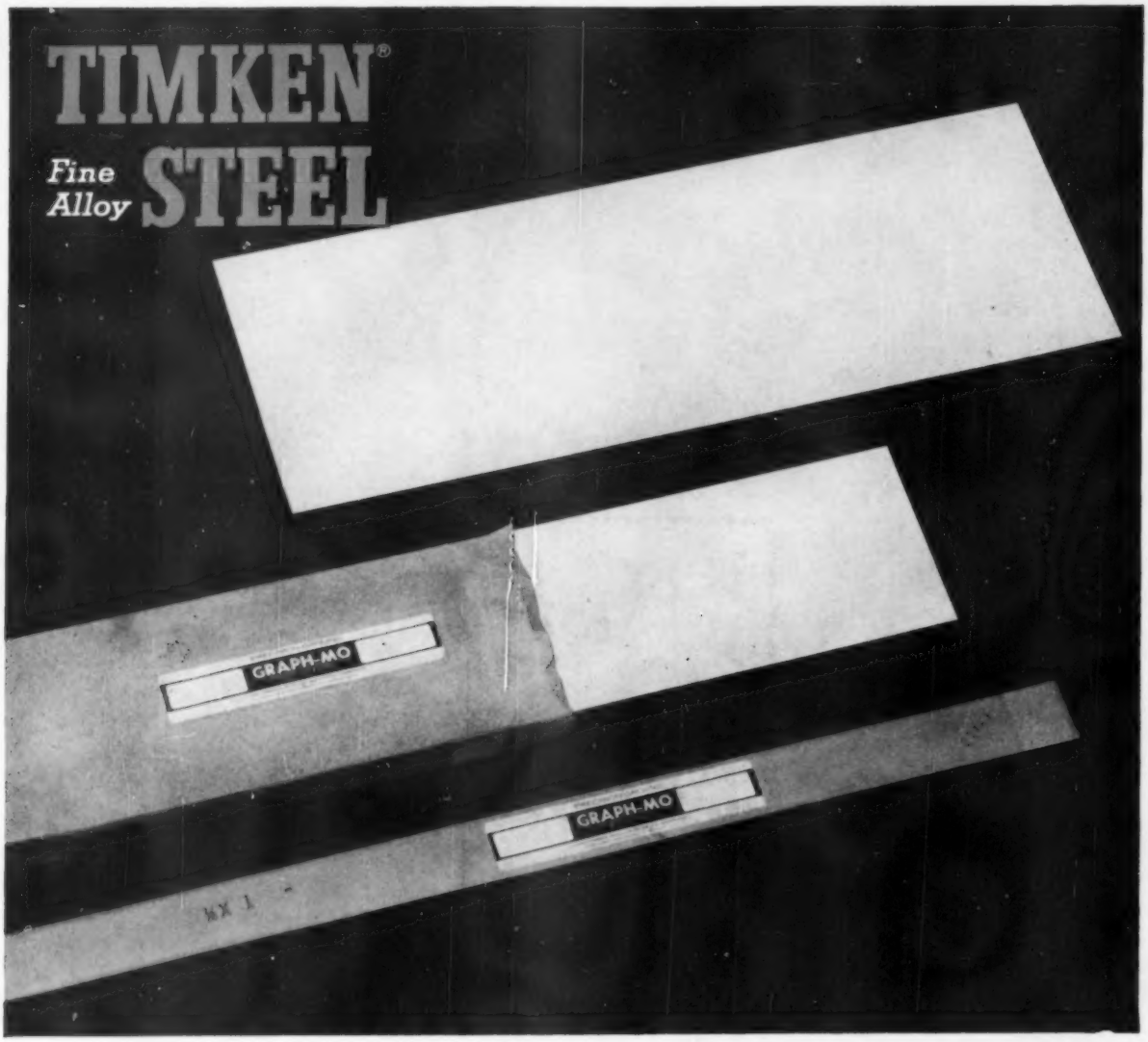

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